CANADIAN ELECTRONICS ENGINEERING

SEPTEMBER 1959
A Maclean-Hunter publication
five dollars a year

SEP 16 1959

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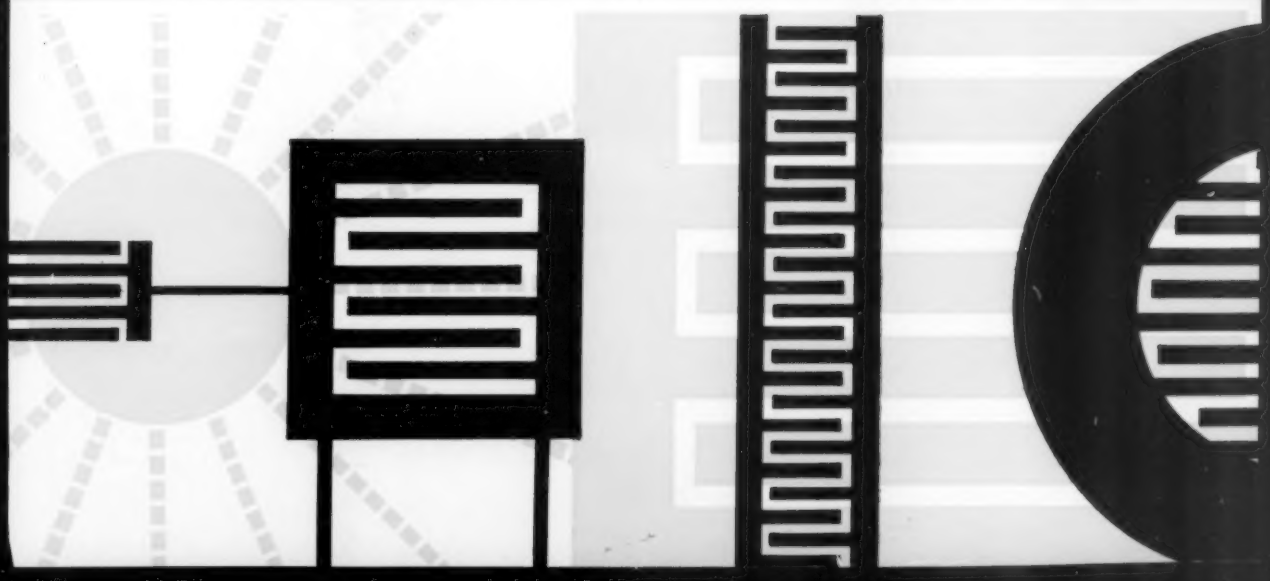

The Landing of the Puritans

On the banks of Gitchie Goomie,
Lake the white men call Atlantic
Heap big redskins going frantic,
*Radar got no Bomac tubes!**

See the Pilgrims land on rock there!
See them cross the sky blue water!
Redskins know they hadn't oughter,
But radar got no Bomac tubes!

Beat the drum, call heap big powow,
Call the braves from heap big teepee,
Get um chief to put on toupee —
Radar got no Bomac tubes!

Fixum Cavity, Bald Eagle!
Get um faulty Klystron going!
Heap big white men come a-rowin
And radar got no Bomac tubes!

Storm Cloud, get those fingers flying!
Mend with rawhide, patch with sticks
Too late now to get um "fix" . . .
Radar got no Bomac tubes!

Redskin radar rests in ashes,
White men use um wood for fire, now.
Price of real estate is higher now . . .
Radar had no Bomac tubes!

On the banks of Gitchie Goomie
Different people now are living,
Every year they give Thanksgiving
Radar had no Bomac tubes!

No. 15 of a series . . . BOMAC LOOKS AT RADAR THROUGH THE AGES

* *Today, Bomac makes the finest microwave tubes and components since the Pilgrims landed*

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Leaders in the design, development and manufacture of TR, ATR, Pre-TR tubes; shutters; reference cavities; crystal protectors; silicon diodes; magnetrons; klystrons; duplexers; pressurizing windows; noise source tubes; high frequency triode oscillators; surge protectors.

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September, 1959

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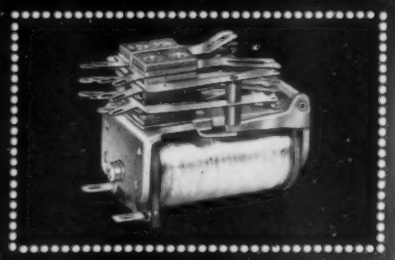
***cover design**

Producing the September cover left art director Frank Davies with psychological problems. Visualizing photocells in sunshine was hard to take during Toronto's heat wave.



213,149,873 cycles

Test proves reliability of P&B's LS telephone type relay

These 16 LS relays, wired into a self-cycling chain, each operated 213,149,873 times before the test was discontinued. This test was made for a nationally prominent manufacturer and the certified results are available upon request.

Here is proof of the inherent reliability of P&B telephone type relays . . . and of the kind of performance you can expect when you specify them. LS relays are available with up to 20 springs (10 per stack) and are adaptable for printed circuit mounting.

Whenever multiple switching of loads up to 4 amperes is required, the LS can usually meet space, weight and—importantly—price considerations. Get full information today by calling or writing Zeke R. Smith, vice president, Engineering, or contact your nearest P&B representative.

LS ENGINEERING DATA

GENERAL:

Breakdown Voltage: 1,000 volts rms 60 cy. min. between all elements.
Ambient Temperature: —55° to +85° C.
Weight: 3 to 4 oz.
Dimensions: 1 5/32" W. x 2 3/8" L. x 1 1/2" H. (4 Form C)
Enclosures: Sealed or dust cover (W can) Sealed or dust cover, up to 6 Form C, single contacts (D can)
Mountings: Four #6-32 tapped holes 3/4" x 5/16" o.c. Other mountings available.

CONTACTS:

Arrangements: 20 springs (10 per stack) max.
Material: 1/16" dia. twin palladium. Other materials available for specific applications.
Load: 4 amps @ 115 volts 60 cy. resistive.

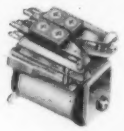
COIL:

Resistance: 55,000 ohms max.
Power: 65 mw DC per movable standard (50 mw possible); 3.5 watts max. at 25° C.
Voltage: Up to 200 volts DC.

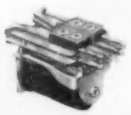
TERMINALS:

Contacts: Three #18 AWG wires.
Coil: Three #20 AWG wires.
Available with octal plug, taper tabs or printed circuit pins.

P&B STANDARD RELAYS ARE AVAILABLE AT YOUR LOCAL ELECTRONIC PARTS DISTRIBUTOR



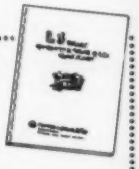
TS RELAY
Short coil relay is available in AC and DC versions. Long life construction. Can be supplied (DC) with up to 20 springs (10 per stack).



GS RELAY
Excellent sensitivity: 50 mw per movable arm minimum (DC). For applications requiring many switching elements in small space.

BS RELAY
Long coil provides high sensitivity (25 mw per movable arm) and room for slugs for pull-in delays (150 milliseconds max.) or drop-out delays (600 milliseconds max.).

FREE
LS DETERMINATION DATA
Send today for booklet containing certified results of recent test described above. Data includes test circuit, interim and final measurements.



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Authorized as second class mail, Post Office Department, Ottawa.

Printed and published by Maclean-Hunter Publishing Company Limited, 481 University Avenue, Toronto 2, Canada. Address all correspondence: P.O. Box 100, Toronto, Canada. EM. 3-5981.

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Other services: The Financial Post Corporation Service: Canadian Press Clipping Service; Commercial Printing Division.

Offices at 1242 Peel Street, Montreal. UN. 6-9841; Room 1004, The Burrard Bldg., 1030 West Georgia Street, Vancouver 5, B.C. MU. 3-8254; Bremen, Germany, Auf den Haefen 12; Maclean-Hunter Limited, 125 Strand, London, England.

Subscription rates: Canada $5.00 per year, two years $9.00, three years $13.00. Single copy price $1.00. U. S. A., United Kingdom, $10.00 per year; all other countries, $20.00 per year.

Indexed in Engineering Index.

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contributors and special articles in this issue:

George France (Characteristics of commercial CdS photocells) spent quite a bit of time investigating the characteristics of commercial photocells for a design project. His findings have been passed on for the benefit of other engineers.

Mr. France, born and educated in England, worked for a number of years for the Air Ministry on radar, and served in the RAF during World War II. After the war he worked in the applied electronics laboratory of General Electric Company on the Sea-Slug missile. Prior to coming to Canada in 1958 he spent six years as chief electronics engineer with Welwyn Electrical Laboratories Ltd. Since coming to Canada he has been with Bach-Simpson Ltd., London, Ont., as a project engineer. Unfortunately, Canada will be losing another engineer later this month when Mr. France returns to England.

CEE's most prolific author may be forced into temporary (very temporary, we hope) silence by the pressure of other duties. **Maurice Price** (Sensitivity charts aid design of potentiometer position comparators) has left Computing Devices of Canada Ltd. and joined forces with a brand-new company, Central Dynamics Limited. This new "potential giant" is in the general field of industrial electronics, control apparatus, and instrumentation. Their plant is located at 147 Hymus Blvd., Pointe Claire, Que., and sales are handled through Aeromotive Engineering Products Ltd.

The United States Services have been engaged in so many interesting research projects it is almost impossible to keep track of them all. The story sent in by Librascope, Inc. (How to mount a telescope on a balloon), serves to illustrate the ingenuity that is helping to extend the frontiers of knowledge.

France

CEE will carry a full pre-IRE Convention story next month. In the meantime, however, preliminary information on technical papers, exhibitors, and special features appears on page 34 (Meeting gains international recognition).

NOW AVAILABLE THROUGH HONEYWELL

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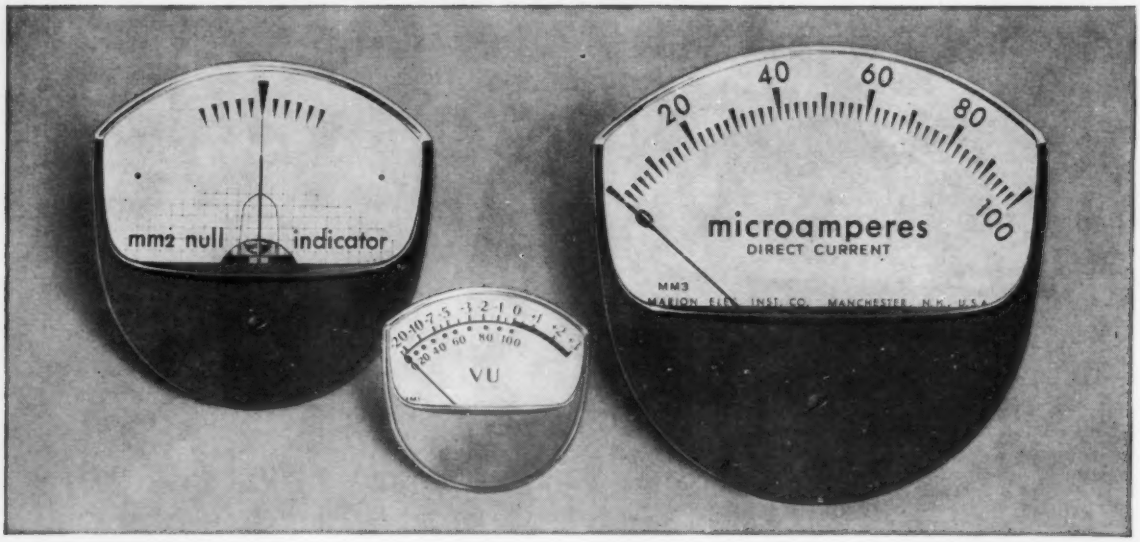
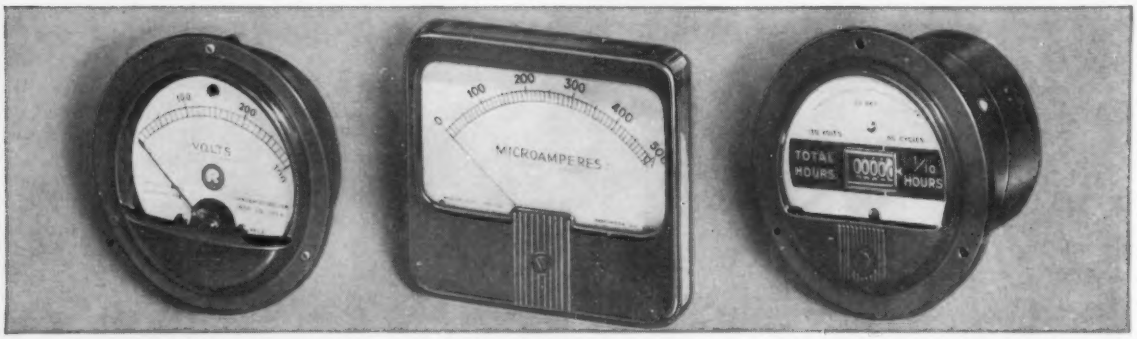


MARION MEDALIST* METERS—ammeters, voltmeters, VU meters and null indicators—are panel instruments of advanced design, providing greater readability and modern styling in minimum space. Available in 16 standard case colors, or custom colors to match your equipment.



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MARION STANDARD PANEL INSTRUMENTS for commercial applications provide improved performance at moderate cost.

MARION ELAPSED TIME INDICATORS, in hermetically-sealed or bakelite cases, record running times in maintenance programming, productivity and utilization studies.

Marion Electrical Indicating Instruments are the latest additions to the growing line of indicating, recording and controlling instruments available from Honeywell. Marion offers eight basic groups of electrical indicating instruments and related products, incorporating the most advanced design concepts and production techniques. For further information, write Honeywell Controls Limited, *Precision Components Division*, Toronto 17, Ontario.

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News highlights . . .

Radar can detect ICBM launchings . . .

The U.S. Navy has developed an experimental radar system capable of very long range detection of missile launchings and nuclear explosions. Project Teepee, headed by Dr. William J. Thaler, involves "high frequency ionospheric back scatter radar" which eliminates the line-of-sight restrictions of existing systems. New installations of conventional radar however will be made in Canada's north to strengthen our defense against the more immediate threat from manned bombers.

Half-year TV sales equal to 1958 . . .

Sales of domestic television receivers in the first six months of 1959 reached 164,381 units, compared with 164,407 to the end of June, 1958. Latest EIA figures also show that radio set sales continued to exceed 1958 levels: sales in the six-month period were 260,254, 22% higher than last year's 223,316.

CNT expect $20 million system order . . .

Announcement may be made in near future on award to Canadian National Telegraphs of a $20 million (approx.) contract by USAF for a 600-channel microwave link between Grande Prairie, Alta. and Snag, Yukon. System would strengthen communications generally between continental U.S. and Alaska, but especially for the new BMEWS base being constructed in the 49th state. Canadian firms receiving subcontracts from CNT would gain competitive strength in respect of orders for military microwave systems in other parts of the world.

Sylvania shuts down television plant . . .

A slowdown in retail sales and high inventory accumulation were blamed for the recent announcement that Sylvania Electric (Canada) Ltd. has ceased operations in its television receiver manufacturing plant at Dunnville, Ont. Company officials hope that it will be possible to reopen the plant to manufacture other products in the electrical and electronics fields.

Cdn. Westinghouse gets NATO contract . . . . . .

One of the first communications orders ever received by a Canadian firm for Western European defense has been awarded to Canadian Westinghouse, Hamilton, by Supreme Headquarters Allied Powers in Europe. Two shf line-of-sight radio systems are to be delivered early in 1960, one being truck-mounted and the other mounted in transportable carrying cases. Société Anonyme de Télécommunications of France will supply multiplex and other associated equipment.

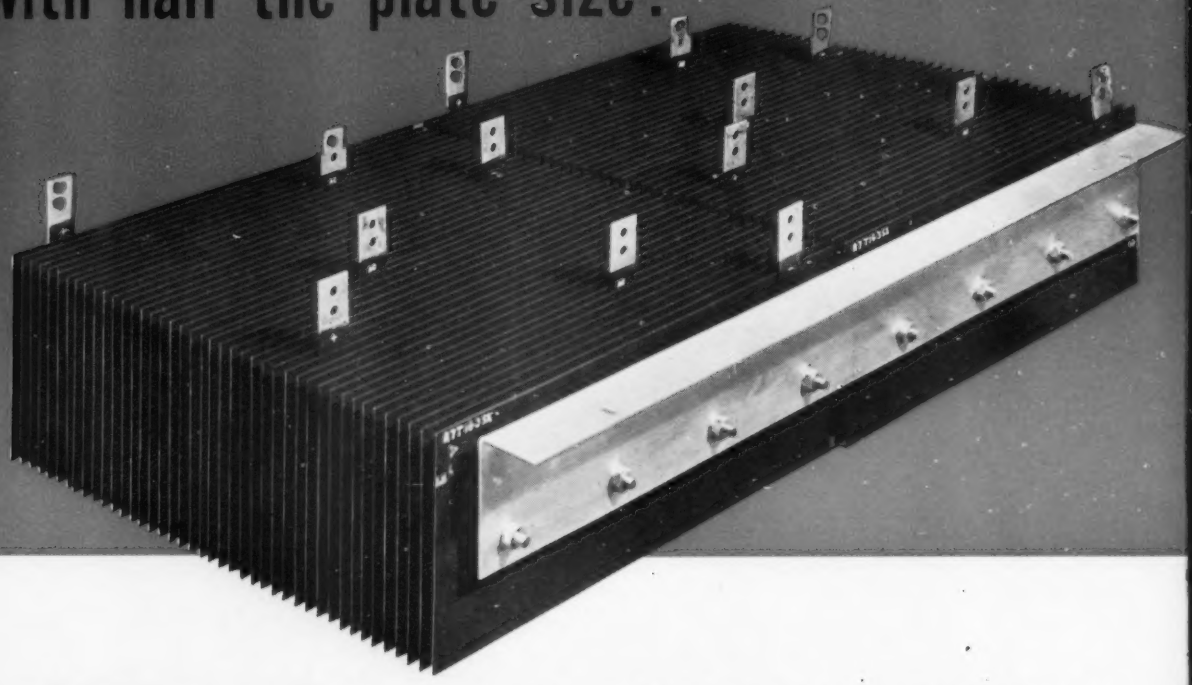
Decca surveillance radar ordered . . .

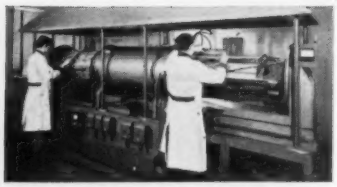
Despite stiff competition from U.S. firms, Decca Radar Ltd. have sold their surveillance radar type DASR 1 for installation at Caracas, principal staging post for the heavy air traffic between North and South America. Solid coverage without gaps is claimed to ranges of 100 miles and heights of 40,000 feet on comparatively small aircraft. It is expected that this type of system will replace the longer wavelength radars now in use.

Color TV "postponed indefinitely" . . .

J. P. Gilmore, Canadian Broadcasting Corporation controller of operations, recently testified before the Commons Committee on Broadcasting that he would not now predict when the CBC would introduce color television. Reasons: apathetic public response in the United States (300,000 color sets sold as against 45 million monochrome sets in use); color ups program costs 25%.

CLM'S New (HCD) Selenium Stacks deliver normal current ratings with half the plate size!





This machine deposits selenium under high vacuum on base plates.

A manufacturing process, recently developed by CLM, has made it possible to use the rectifying properties of selenium more fully. CLM rectifiers will carry twice the current per unit area of conventional selenium rectifiers, because of their superior electrical characteristics, extremely low losses and high efficiency. The new technique uses specially developed high vacuum equipment to deposit a thin selenium layer of great uniformity on the base plate. It also features a new rectifier junction of a p-n structure. Accelerated life tests indicate stable performance of the new rectifier stacks and a life expectancy of 100,000 hours.

Current ratings are approximately double those formerly established by NEMA. CLM (HCD) selenium stacks are available in 13 different plate sizes ranging from 1″ x 1″ to 6″ x 16″. Efficiencies are exceptionally high, over a wide range of load.

CLM-HCD-SELENIUM stacks cannot be destroyed by transient currents and voltages and, therefore, do not need additional protective devices. They can be operated within a temperature range of —60°C to +75°C ambient with negligible changes of reverse leakage and forward drop.

Extra HCD plates are available at 3 and 4 times NEMA for special applications.

For bulletin SR-15-1 write Jack West, Product Manager, Rectronic Division, Canadian Line Materials Toronto 13, Canada.

HIGH CURRENT DENSITY (HCD) SELENIUM RECTIFIERS

CLM

CANADIAN LINE MATERIALS

Toronto 13, Canada

DIVISION OF McGRAW-EDISON COMPANY (CANADA) LIMITED

McGRAW EDISON

McGill graduate appointed sales manager of Andrew Antenna

Ross H. Curtis has been appointed sales manager of Andrew Antenna Corp. Ltd., Whitby, Ont. A graduate engineer, Mr. Ross attended Loyola College and McGill University. He has been associated with Sperry Gyroscope Co. of Canada and with RCA Victor Co. Ltd. While with Sperry, Mr. Ross was a technical representative with the RCAF in Europe.

Curtis

Sanctuary

Varian

John Annett, a graduate engineer from the University of Toronto, has been promoted to the position of sales engineer, Mr. Annett has been on special assignment since joining the company over a year ago.

Radar pioneer moves south

A member of Sir Robert Watson-Watt's original radar research team, **C. Sanctuary,** has joined Del Mar Engineering Laboratories in Los Angeles. For the past five years he has been chief engineer of Decca Radar (Canada) Ltd., Toronto.

Mr. Sanctuary served with the British Air Ministry at Bawdsey Research Station, England, before World War II. While there he participated in electronics development programs and in the initial phases of the British early warning radar system that played a decisive part in the Battle of Britain.

Dr. Russel H. Varian dies of heart attack

While on a vacation cruise in Alaska last month **Dr. Russel H. Varian,** chairman of the board of Varian Associates, died of an unexpected heart attack. He was 61 years old.

Dr. Varian was born in Washington, D.C., but moved to California at the age of four. He graduated from Stanford University with a Bachelor's degree in physics in 1925, and a M.S. degree in the same subject in 1927. It was at the physics laboratories at Stanford that Dr. Varian, working with his brother Sigurd and other associates, developed the Klystron in 1939. He continued his work on the Klystron at Sperry Gyroscope Co. during World War II. In 1948 he returned to Palo Alto, Calif., and founded Varian Associates.

Dr. Varian held patents on more than 100 devices in the fields of thermionic tubes, radar, missiles and nuclear magnetic resonance. He was a Fellow of the American Physical Society, the Institute of Radio Engineers, and the California Academy of Sciences. He received a number of honors for his scientific work.

Senior research associate

H. C. Ratz, P.Eng., has been appointed senior research associate in the College of Engineering at the University of Saskatchewan. He will head a new laboratory in the field of data processing systems.

Mr. Ratz, born and raised in Hamilton, Ontario, received his B.A.Sc. degree in Engineering Physics at the University of Toronto. He received the S.M. degree from the Massachusetts Institute of Technology.

Formerly a design engineer in the automation and data systems section of Fischer & Porter (Canada) Ltd., Mr. Ratz is a member of IRE, AIEE, Canadian Association of Physicists, and the Royal Astronomical Society of Canada.

Laws takes on additional duties

Alan Laws has been appointed plant manager of Potter & Brumfield Canada Ltd. Mr. Laws joined the company in 1958 and was appointed sales manager earlier this year. He will continue to direct the sales of the company in his new position as well as oversee all other aspects of the plant's operation. He succeeds Marlin A. Kirk who has returned to the parent company in the U. S. to become staff assistant to the executive vice-president.

Mr. Laws was born in Lloydminster, Sask. and received his education there and in England. During the Second World War he served with the Somerset Light Infantry with the rank of major. He commanded a bomb disposal unit until 1947, then returned to civilian life to work in public relations and sales promotion.

Aviation sales and service appointments

Computing Devices of Canada Ltd. has appointed **James Male** as aviation service manager. He will be responsible for service on Bendix aviation radio and radar. Born and educated in Scotland, he served for 19 years as an electronics and radar technician in the RAF. He came to Canada in 1952 and served with the RCAF before joining Computing Devices of Canada Ltd.

B. C. J. (Bud) Sinclair has been appointed U. S. aviation sales engineer. His primary responsibility will be sales of the CDC position and homing indicator. Mr. Sinclair is a graduate of the University of Toronto in mechanical engineering. He has held a commercial pilots license since 1953, and is a member of the Association of Professional Engineers of Ontario.

Male

ASHLEY & CRIPPEN

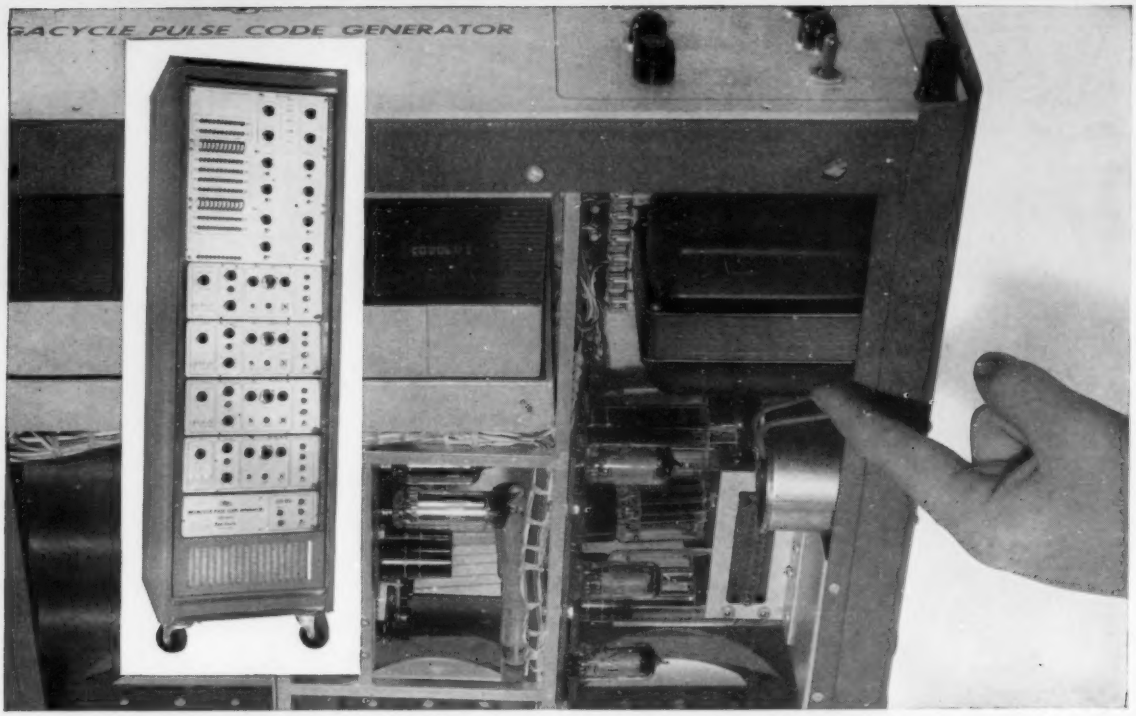
Capell

Supervisor of radio- tv-electronics division

The activities of the radio-tv-electronics division of Zenith Radio Corp. of Canada Ltd. will be under the supervision of **Sydney L. Capell.** As a consultant with Zenith since 1957, Mr. Capell has been active in the formation of the division, and the establishment of the Canadian corporation's operations in Toronto and Montreal in 1958.

From 1936 to 1953 Mr. Capell was vice-president and general manager of Philco Corp. of Canada Ltd.

(Continued on page 45)



Sola Constant Voltage Filament Transformer is an integral part of this Electro-Pulse, Inc. Megacycle Pulse Code Generator. It provides regulated filament voltage for reliable operation of the equipment and for full life of its electron tubes.

Sola transformer regulates filament voltage within ±1%--protects tubes from inrush currents and line transients

Fluctuations in supply voltage for electron tube filaments can be costly . . . in shortened tube life . . . in substandard performance . . . in equipment downtime. Electro-Pulse, Inc. solved its filament voltage problems through this straightforward approach: the company's Megacycle Pulse Code Generator includes a Sola Constant Voltage Filament Transformer built-in as part of its power supply.

This versatile unit does the step-down job of a conventional transformer and it also regulates the filament supply — a task that ordinary filament transformers don't pretend to do. Filament voltages are stabilized to within ±1% even with line voltage variations as great as ±15%. Its current-limiting characteristic protects tubes from cold inrush currents upon starting—as well as from line transients. It is a simple, reliable static-magnetic regulator with automatic and virtually instantaneous action. Variations in input voltage are usually corrected within 1.5 cycles. There are no tubes or moving parts, and no manual adjustment or maintenance is necessary.

The filament voltage regulator illustrated is only one of a complete line of Sola Constant Voltage Transformers having wide application in electrical and electronic devices. They include such special types as harmonic-free, plate-filament, and adjustable output units—all provide the benefits of regulated input voltage. More than 40 ratings of these compact, economical regulators are available from stock, and Sola manufactures custom-designed units (in production quantities) to meet special needs.

For complete data write for Bulletin 521-CVF-269

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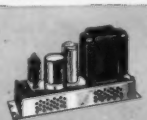
CONSTANT VOLTAGE TRANSFORMERS


REGULATED DC POWER SUPPLIES

MERCURY LAMP TRANSFORMERS

FLUORESCENT LAMP BALLASTS

Mobile laboratory will monitor radio and tv stations

An electronic laboratory on wheels left Ottawa last month on its maiden detective mission — a tour of Ontario and Quebec to police the airwaves in these provinces.

Recently delivered to the Department of Transport, this new mobile monitoring station will check the transmissions of radio and television stations across Canada.

The specially designed tractor-trailer is surmounted by a 35-foot antenna and contains close to $100,000 worth of equipment. It was designed by Ted Groves, a radio regulations engineer with DOT, to supplement the eight fixed monitoring stations across the country.

Equipment includes a spectrum analyzer, four radio receivers, a television receiver and an eight-speed tape recorder. Frequency coverage is from 10 kc to 10 mc.

Automatic Electric to build in Alberta

Automatic Electric (Canada) Ltd. plans to establish a new plant in Western Canada to provide additional manufacturing, assembly and warehouse facilities. Most favored location is Lethbridge, Alta.

Arrangements for the building and layout of manufacturing space are now under way, according to C. R. Hughes, president. Construction is expected to be completed by year-end and the plant ready for gradual occupancy.

"The move will permit us to expand the production of our main line of switchgear equipment at Brockville and at the same time introduce more Canadian-made products to the Canadian market," said Mr. Hughes.

Firms team facilities on Lear products

A team of four Canadian companies has been formed for the Canadian manufacture of equipment designed by Lear, Inc. The four firms, Railway & Power Engineering Corp. Ltd., Canadian Flight Equipment Cobourg Ltd., Servomechanisms (Canada) Ltd., and Tamper Ltd. have organized to provide Lear products with the highest possible Canadian content at prices comparable with those of the U. S.

Railway & Power Engineering will perform the over-all management function and co-ordinate the manufacturing. Servomechanisms will manufacture electronic assemblies, while Canadian Flight Equipment will produce mechanical components. Tamper will manufacture the airborne rotating equipment.

Lear products include automatic flight control systems, flight reference systems, gyros, stable platforms, servos and actuators. Purpose of the team concept is to make the most effective use of existing specialized facilities.

New Seabreeze plant locates in Ontaario

Seabreeze Manufacturing Ltd., Toronto, has moved its business and manufacturing facilities from River St. to a new plant at 66 Jutland Ave., Etobicoke, early in August. The new plant has more than 60,000 sq. ft. of floor space and is designed with a removable rear wall for expansion. Of one-story brick and glass, it has a cafeteria, printing department and special soundproof audio room in addition to office and production areas.

Sales engineer for Beckman Instruments

David C. Nelson has been appointed field sales engineer, scientific instruments, for the Seattle, Wash., office of the Scientific and Process Instruments Division, Beckman Instruments Inc. Mr. Nelson's territory will include Western Canada.

Missiles and systems division

Canadair Ltd. has formed a new Missiles and Systems Division to consolidate its activities in the field of guided missiles, automatic products and other products not directly related to aircraft. R. D. (Dick) Richmond has been appointed vice-president in charge of its operation.

Mr. Richmond, born in Winnipeg, received his B.S.E. in aeronautical engineering from the University of Michigan. He is a fellow of the Canadian Aeronautical Institute and a member of the Engineering Institute of Canada.

Enters transistor shortwave field

Introduction of a nine-band, all transistor portable radio — the All-World—marks the entry of Canadian Admiral Corp. Ltd. into the transistor shortwave field. Using transistors and diodes, weighing 13 lb., it is claimed by Admiral to be the smallest nine-band portable on the market. It reportedly delivers 750 milliwatts of undistorted power.

CGE will build radar for Royal Australian Air Force

Canadian General Electric Co. Ltd. has been awarded an Australian defense contract valued at more than $250,000 for the production of height-finding radar equipment. The equipment, to be used for Australia's radar defense lines, is similar to that used on Canada's Pinetree Line.

The contract is the second to be received by CGE this year for this type of equipment. The USAF placed a $9,000,000 order for height-finding radar equipment last February.

International Systcoms gets financial backing

Charterhouse Canada Ltd., a U. K.-owned private banking firm, has arranged long-term financing for International Systcoms, Ltd., Montreal. The company was founded in 1957 by John J. Kingan. Prior to this Mr. Kingan was a vice-president of RCA Victor Co. Ltd. He had also served with

(Continued on page 45)

Ronald Price, right, Ontario sales manager for Instronics Ltd., Stittsville, Ontario, accepts delivery of eight tons of Racal communications receivers at Dorval Airport, Montreal. Valued at over $150,000, the equipment was flown from the U. K. in a chartered B.O.A.C. Stratocruiser.

Canadian Electronics Engineering presents its October preview of the 1959 IRE CANADIAN EXPOSITION

Canada's outstanding electronics event during 1959 will be the IRE Exposition to be held in Toronto on October 7th, 8th and 9th. In its October issue, Canadian Electronics Engineering will completely preview this important occasion with 32 pages of Convention and Exposition news.

The special Exposition section will present a description of the full program, with a floor plan of exhibits, abstracts of technical papers and a list of exhibitors' booths and personnel. A description of the products to be on display will be given and the whole section will be printed on a special, distinctive colored stock.

This issue, of unusual interest to all visitors to the Exposition, will also receive close attention from those in electronics who are unable to attend the show.

Builds traffic to exhibits.

As an exhibitor at the IRE Exposition, you can help get maximum attendance at your booth through the pages of CEE's October issue. Tell visiting electronics buyers about your exhibit and the features of your products in advance — reserve extra advertising space in CEE's October Exposition issue.

Builds sales to electronics buyers.

CEE's October issue provides you with an excellent opportunity to show your products to all those electronic equipment buyers unable to attend the IRE show The complete coverage given the IRE Exposition in this special issue of Canadian Electronics Engineering will attract unusual attention among key personnel in every phase of electronics.

Reserve space early . . . closing date is September 15th.

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A MACLEAN-HUNTER PUBLICATION

HOW TO SUCCEED WHILE YOU'RE STILL YOUNG

IT SURPRISES many people to learn that the average age of the men who respond to our advertisements is closer to forty than to twenty. But it's not hard to understand why this is true!

Most young men are *satisfied* with their progress in business. Their native ability and energy are enough to win them regular promotions and salary increases. They find success only a matter of time.

But the day comes, often with a shocking suddenness, when this easy and casual progress ends abruptly.

Many a man wakes up with a start in his thirties or forties to find that his income has leveled off, and that promotions have ceased.

"I'm not getting ahead as fast as I should," he says to himself. "Where am I going to be ten years from now?"

Why does this pathetic pattern appear in so many promising careers?

The answer is simple: Sheer ability and energy can carry a man to the mid-way point in business . . . *but only a thorough knowledge of business fundamentals can help him beyond that point.*

If you realize that fact while time is still on your side—and act on it—*you can succeed while you're still young.*

FREE . . . "FORGING AHEAD IN BUSINESS"

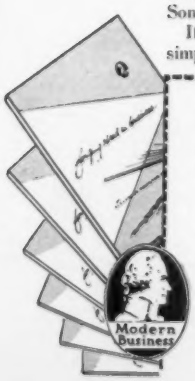
We do not claim that you must have the Alexander Hamilton Course in order to succeed in business. But we do say that *you cannot succeed without what is in the Course!*

All the Institute does is offer you a convenient and time-saving means of bringing this knowledge to you in your spare time; and in a form that has *proved* to be practical and effective for more than forty years.

So that you may judge for yourself whether or not you think the Institute can help you, we have published an informative 48-page book titled "Forging Ahead in Business."

We believe that this little book will help any man get down to bedrock in his thinking; however, there's no cost or obligation for it because—frankly—we've never been able to put a price on it that would reflect its true value. Some men have found a fortune in its pages.

If you would like a complimentary copy of "Forging Ahead in Business", simply sign and return the coupon below. It will be mailed to you promptly.



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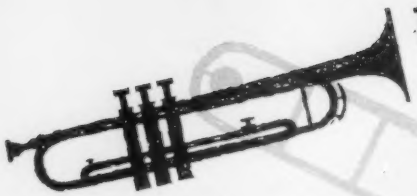

hit a new high in sound quality

a new low in hum level

with CGE's new improved

* Replaces 12AX7, ECC83, 7025.

7025A/12AX7A*

Give your high fidelity equipment a "New Sound" with the 7025A/12AX7A audio amplifier tube, designed and developed by CGE engineers.

With improved performance rating over the 12AX7, ECC83 and 7025, the 7025A/12AX7A is a new tube throughout, that meets the most critical requirements of the finest audio systems.

Lower hum—more than 20 db below prototypes. Reduced microphonics—less than one eighth of prototypes.

Here's why:

- Side mounted getter to reduce leakage on micas.
- Coiled hairpin filament for lower hum.
- Triple micas to reduce microphonics.
- Cathodes mounted under tension for extra rigidity.
- Improved mica design with closer tolerances.

Choose the 7025A/12AX7A and increase the quality and acceptability of your finest audio systems. For full information contact Canadian General Electric Co. Ltd., Electronic Tube Section, 189 Dufferin Street, Toronto.

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Electronic Tube Section

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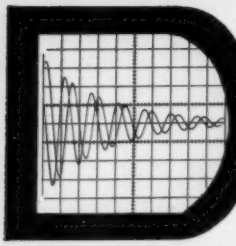
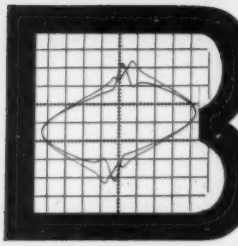
Dual Beam

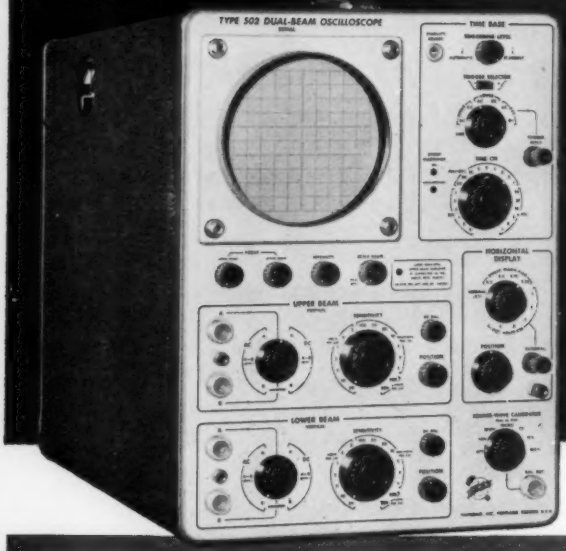


DUAL DISPLAY ON LINEAR TIME BASE—Comparison of waveforms at two points in a ringing circuit. This kind of display is useful in many types of investigation.



DUAL-BEAM X-Y CURVE TRACING—Typical production-test application: display of EI loops of two transformers manufactured under identical conditions.

Type 502 Tektronix Oscilloscope



TWO-GUN CATHODE-RAY TUBE.

200 μv/cm SENSITIVITY, BOTH BEAMS.

DIFFERENTIAL INPUT, ALL SENSITIVITIES.

2, 5, 10, and 20 TIMES SWEEP MAGNIFICATION.

X-Y CURVE TRACING with TWO BEAMS—(horizontal input sensitivity to 0.1 v/cm).

SINGLE-BEAM X-Y CURVE TRACING at 200 μv/cm, BOTH AXES.

EXTRA FEATURE—Both amplifiers have transistor-regulated parallel heater supply.

TYPE 502 CHARACTERISTICS

HIGH-GAIN AMPLIFIERS

200-microvolts/cm deflection factors, both dc-coupled and ac-coupled. 16 calibrated steps from 200 μv/cm to 20 v/cm.

Passbands — dc-to-100 kc at 200 μv/cm, increasing to dc-to-200 kc at 1 mv/cm, dc-to-400 kc at 50 mv/cm, and to dc-to-1 mc at 0.2 v/cm. Vertical response at the lower sensitivities varies according to switch position as follows: 0.5 v/cm—dc-to-300 kc; 1 v/cm—dc-to-500 kc; 2 v/cm—dc-to-1 mc; 5 v/cm—dc-to-300 kc; 10 v/cm—dc-to-500 kc; 20 v/cm—dc-to-1 mc.

Differential Input, Both Channels—Rejection ratios: 1000-to-1 at 1 mv/cm or less, 100-to-1 at 0.2 v/cm, 50-to-1 at 5 to 20 v/cm.

Constant Input Impedance, 1 megohm, 47 μμf, both channels.

WIDE-RANGE SWEEP CIRCUIT (Common to both beams)

Single-knob control for selecting any of 22 accurately-calibrated sweep rates from 1 μsec/cm to 5 sec/cm.

Sweep Magnification—2, 5, 10, and 20 times, accurate within the maximum calibrated sweep rate.

Automatic Triggering—fully automatic, or preset with amplitude-level selection when desired. Sweep can also be operated free-running.

X-Y CURVE TRACING OPERATION

Horizontal-input amplifier permits curve-tracing with both beams simultaneously at sensitivities to 0.1 v/cm. For curve-tracing at higher sensitivities (to 200 μv/cm) with one beam, one of the vertical amplifiers can be switched to the horizontal-deflection plates.

OTHER FEATURES

Amplitude calibrator, 1 mv to 100 v in decade steps — square wave, frequency about 1 kc.

3-kv accelerating potential on new Tektronix 5" dual-beam crt. 8-cm by 10-cm linear-display area, each beam, 6-cm overlap.

Electronically-regulated power supplies.

Price . . . **$825** f.o.b. factory

Here are a few uses for the Type 502:

IN ELECTRONICS—Use the Type 502 as a general-purpose oscilloscope and also to show simultaneously the waveforms at any two points in a circuit, e.g. input and output, opposite sides of a push-pull circuit, trigger and triggered waveform, etc.

IN MECHANICS—Display, compare, and measure outputs of two transducers on the same time base; plot one transducer output against another—pressure against volume or temperature for instance; measure phase angles, frequency differences, etc.

IN MEDICINE—Display, compare, and measure stimulus and reaction, or the outputs of two probes, on the same time base; use differential input to cancel out common-mode signals, or to eliminate the need for a common terminal; use in routine investigations, etc.

IN ALL FIELDS—The Type 502 can save you more than its cost in time—in as little as one application!

Tektronix, Inc.

P. O. Box 831 • Portland 7, Oregon
Phone CYpress 2-2611 • TWX-PD 311 • Cable: TEKTRONIX

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NEW FROM PHILCO

HIGH FREQUENCY NPN SILICON DIFFUSED-BASE TRANSISTORS

30mc PULSE RATE SWITCHES

Type Number	hfe	Typical Power Gain	Typical Switching Times (Saturated Test Circuits)
2N1199	12-60(DC)		tr 35 mμ sec ts 10 mμ sec tf 25 mμ sec
2N1267	6-18	25 db at 4.3 mc	
2N1268	11-36		
2N1269	28-90		
2N1270	6-18	25 db at 12.5 mc	
2N1271	11-36		
2N1272	28-90		

Maximum Vcb—20 V
Maximum temperature—150° C
Maximum dissipation—100 MW

60mc AMPLIFIERS

2N1199

This high speed switch has exceptionally low saturation voltage (typically 0.125 V), permitting *practical* design of 5 mc pulse circuits, using conventional saturated switching configurations. 30 mc pulse rates are obtainable in *practical* circuits using non-saturating techniques.

2N1267-68-69

The high gain characteristics of these units make possible the design of high efficiency IF amplifier circuits for communications equipment. These devices have unusually low collector capacitance . . . typically 1.5 μμf . . . and are available with restricted beta ranges to simplify design problems.

*SADT . . . Trademark Philco Corp. for Surface Alloy Diffused-base Transistor

2N1270-71-72

The excellent high frequency response of these transistors makes practical the design of high performance communications systems at frequencies up to 60 mc. They have the same low collector capacitance and are available with restricted beta ranges.

Philco Corporation of Canada, Don Mills, Ontario

Please send complete information on the SADT type transistors and descriptive brochure of all type transistors available.

NAME_____

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This forthcoming report by editors of The Financial Post will have the close attention of decision-making executives in many different fields of industry across Canada. It will feature the program and discussions to be presented at the Institute of Radio Engineers Canadian Convention and Exposition, October 7, 8 and 9 in Toronto.

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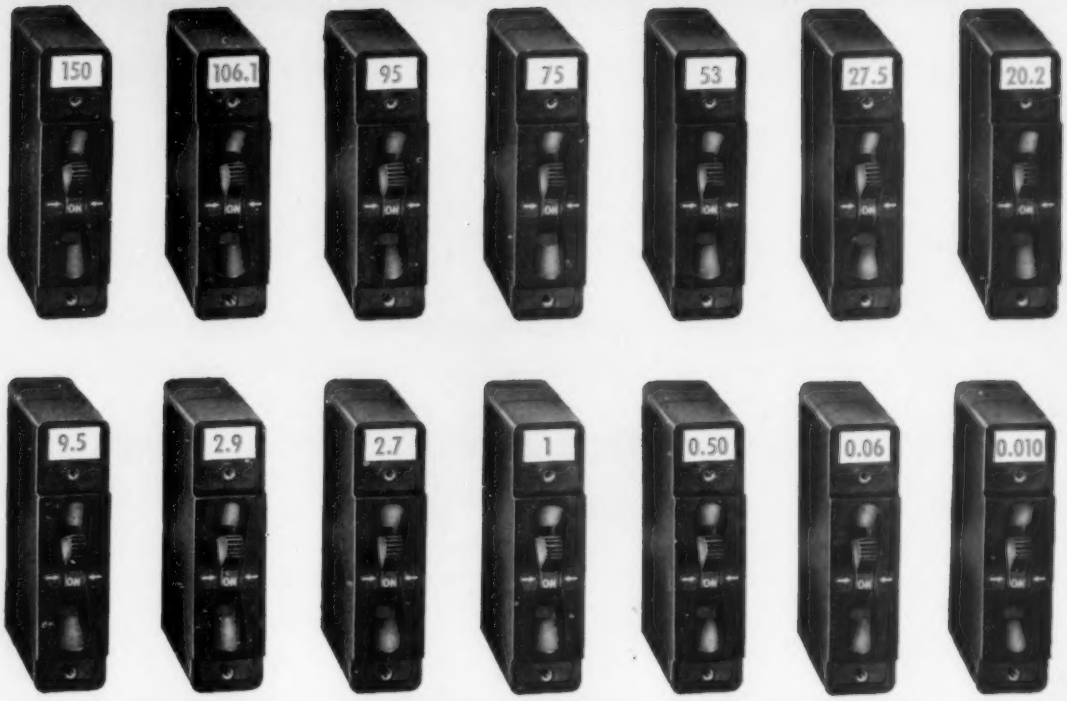

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circuit breaker ratings as low as 0.010 amperes

HEINEMANN Circuit Breakers—complete with your choice of inverse time-delay curves or instantaneous trip—are available in current ratings *as low as 0.010 amperes* . . . an important fact to remember when considering the protection of sensitive equipment. For even at a rating of only 0.010 amperes, HEINEMANN Circuit Breakers still provide fastest interruption of short circuits, retain their set trip points and carry rated capacity through any ambient temperature range, high or low. These exclusive HEINEMANN features are yours in any odd or fractional current rating you may specify . . . but only when you specify HEINEMANN. *For complete details, send for the Circuit Breaker Engineering Guide, Bulletin 201.*

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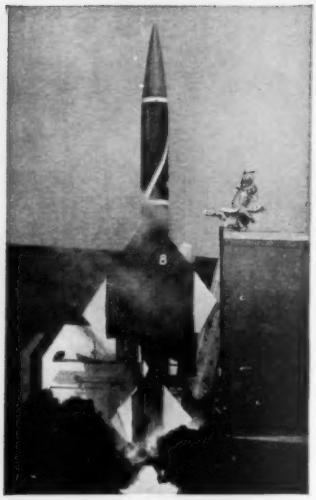
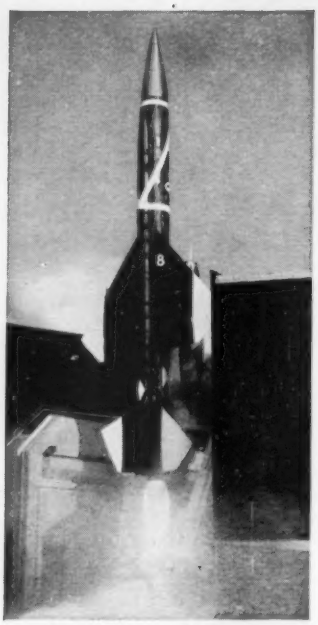
Circuit breakers

BORG ...a world of ideas... *that work*





BOEING NEEDED SPECIALTY ENGINEERING...

AND GOT IT...FROM BORG

A FEW BORG DEVELOPMENTS

- FREQUENCY STANDARDS
- AIRCRAFT INSTRUMENTS
- PRECISION POTENTIOMETERS
- MULTI-TURN COUNTING DIALS
- FRACTIONAL H. P. MOTORS

Boeing Airplane Co. needed special potentiometers for the guidance systems of their deadly Bomarc surface-to-air missiles. The necessary potentiometers had to withstand severe vibration and shock and still retain uncanny accuracy within extreme tolerances. The solution to this difficult reliability problem? The design, development and production facilities of the Borg Equipment Division of the Amphenol-Borg Electronics Corporation. The result? Specially designed potentiometers exceeding all required specifications. Many industry leaders have found that they can depend on Borg engineering skill and cooperation. Call on Borg when you are faced with difficult design, development or production problems. Chances are you'll save a good deal of time and money and find it makes good sense to call on Borg. Write for our new facilities brochure.

BORG

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JANESVILLE, WISCONSIN

Canadian "Tech-Rep", Atlas Radio Corporation Ltd., 50 Wingold Ave., Toronto, Phone: RU 1-6174

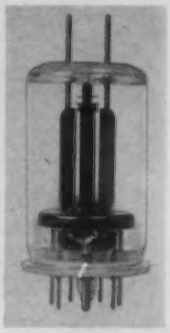
Clip and file this reference sheet for future use

ROGERS REFERENCE BULLETIN NO. 1

Rogers tube type 5894 for 150 M/c mobile transmitters

The Rogers 5894 is a transmitting double tetrode capable of giving 30 watts output, CCS, in a conservative manner under the field conditions met in mobile communications. It is further capable of giving extreme reliability as a base station output tube producing 60 watts.

Great uniformity is achieved from tube to tube and also in the current division within each tube, with the Rogers 5894.



- *Each anode is capable of dissipating 20 watts.*
- *The cathode is indirectly heated and oxide-coated.*
- *Maximum ratings apply up to 250 megacycles.*
- *At reduced ratings the 5894 may be operated at up to 500 megacycles.*
- *To ensure neutralization over the entire operating band, the tube has built-in cross neutralizing capacitors, the value of which is adjusted to the direct grid-plate capacities.*

TECHNICAL DATA

ELECTRICAL

CATHODE: indirectly heated, oxide coated

	Heater sections in parallel	Heater sections in series	
Heater voltage 1)	6.3	12.6	V
Heater current	1.8	0.9	A
pins	5-(1+7)	1-7	

DIRECT INTERELECTRODE CAPACITANCES

	each unit	both units in push-pull	
Output capacitance	3.2	2.1	pF
Input capacitance	10.5	6.7	pF
Anode to grid No. 1 (internally neutralized) max.	0.08		pF

AMPLIFICATION FACTOR (*each unit*)

grid No. 2 to grid No. 1 — 8.2

MUTUAL CONDUCTANCE (*each unit*)

at anode current = 30 mA — 4.5 mA/V

LIMITING VALUES AND OPERATING CONDITIONS

H.F. CLASS C TELEGRAPHY

C.C.S. limiting values (absolute limits)

Frequency	max.	250 Mc/s	500 Mc/s
Anode voltage	max.	750 V	600 V
Anode input power	max.	2x60 W	2x50 W
Anode dissipation	max.	2x20 W	
Anode current	max.	2x110 mA	
Screen-grid Voltage	max.	300 V	
Screen-grid dissipation	max.	2x3.5 W	
Control grid voltage	max.	-175 V	
Control grid current	max.	2x5 mA	
Resistance between control grid and cathode	max.	50 k Ohms	
Voltage between cathode and heater	max.	100 V	

OPERATING CONDITIONS (*two sections in push-pull*)

	C.C.S.				
Frequency	200	250	430	500	Mc/s
Anode voltage	600	750	520	500	V
Control grid bias	-80	-80	-80		V
Common control grid bias resistor				20	k Ohms
Screen-grid voltage	250	250	250	250	V
Anode current	2x100	2x80	2x100	2x100	mA
Control grid current	2x2.5	2x1.5	2x2.8	2x3	mA
Screen-grid current	16	17	18	20	mA
Peak grid-to-grid driving voltage	200	250			V
Screen-grid dissipation	4	4.25	4.5	5	W
Anode input power	2x60	2x60	2x52	2x50	W
Anode dissipation	2x15	2x17.5	2x19	2x20	W
Tube output	90	85	66	60	W
Tube efficiency	75	71	64	60	%

This reference sheet is the first in a series from Rogers to keep you fully informed of electronic developments. A specially designed file folder for these bulletins is available from Rogers on request.

You are invited to make full use of Rogers Application Engineering Service at any time, on any problem. Just phone or drop us a line.

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electronic tubes & components
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5919

AUTOMATIC ELECTRIC

ORIGINATORS OF THE DIAL TELEPHONE

GENERAL SYSTEM

How much protection do we need?

The Board of Broadcast Governors has recently suggested a form of protection for Canadian writers, artists and others by stipulating that at least 55% of the program content of television stations be of Canadian origin. The electronics manufacturing industry, and with it this publication, are not primarily concerned with matters of non-technical broadcast regulation. But the interests of that considerable portion of the industry that produces receivers and their components are inevitably related to the possible effects of such a decision on their market. These effects will require careful examination over the months and years ahead.

In the meantime, the industry still carries the burden of the 15% excise tax on radio and television receivers, electronic phonographs, tubes and associated components. This tax is being applied to help finance the Canadian Broadcasting Corporation, and was the subject of a comment on this page in July, 1958.

A further thought now occurs, however, prompted by the BBG's announcement: Could not the revenue from the excise tax levy be used for the direct support of the electronics industry? By definitely assigning these funds to the subsidization of research and development both within the CBC and in industry, Canada could be put much further along the road to technological leadership. It would also put our electronics manufacturers in a much better position to combat the foreign competition which is now a serious threat.

Some such action must be taken, or we may all find ourselves viewing Canadian programs on imported receivers.

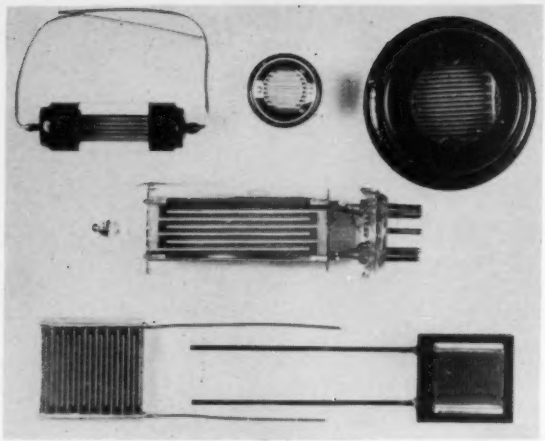
IRE Canadian Convention

In just over four weeks the doors of the Automotive Building in Toronto's Exhibition Park will open on the fourth IRE Canadian Convention and Exposition. Now is the time—if you have not already done so—to plan your attendance at the most important event in our industry's year.

The Convention executive and its various committees have lined up a strong technical program, an interesting array of exhibits, and other events. A preliminary roundup of Convention news appears on pages 34 to 36, and Canadian Electronics Engineering will again present a comprehensive preview of the show in the October issue.

Thousands of representatives of the electronics and nucleonics industries, educational, research and medical establishments will be present. Plan to be among them and gain the maximum benefit from this annual showcase of products and ideas.

THE EDITOR



Cadmium sulphide photocells are available in a variety of configurations, sizes and operating characteristics

Survey shows . . .

Characteristics of commercial cadmium sulphide photocells

Cadmium sulphide photocells are photo-resistive devices capable of operating relays directly on ac or dc. They are suitable for use in alarm, control and counter circuits. Typical design curves are given, followed by a table of characteristics for several commercially-available CdS photocells.

GEORGE FRANCE*

The cadmium sulphide photocell is a photo-resistive device; its resistance varies inversely with the intensity of the light applied to it. Its resistance also varies somewhat with applied voltage, under constant light conditions, this effect being more pronounced at low voltages.

It differs from most other photo-conductive cells in its ability to dissipate a comparatively large amount of power (up to one watt) and its very low resistance when subjected to strong light. Cells are available with a resistance of under 100 ohms when operated at 100 foot candles and 10 volts. The cadmium sulphide cell is also one of the most sensitive photo cells available; its sensitivity being only exceeded by that of the photo-multiplier tube.

The characteristics of these cells make them particularly suitable for use in such applications as fire alarms, flame failure alarms, liquid level controls, automatic lighting controls, industrial counters and safety devices. Their ability to dissipate a fairly large amount of power and their low resistance under the influence of a reasonable amount of light energy make them capable of controlling relays directly, without intermediate amplification.

In counter circuits most photocells are used as on-off devices; a light source of approximately constant intensity is interrupted by the object to be counted. Under these conditions the cell can control a load power considerably greater than its rating, as the power dissipated by the cell is relatively small, both with the light on and off, and reaches its maximum during the brief period when the light is changing from one level to the other. The mean power of the cell is then a function of the peak power at each interruption and the frequency of the interruptions plus a constant due to the steady state conditions.

*Bach-Simpson Limited, London, Ontario.

Curves show operating conditions

Figure 1 shows the characteristics of a typical commercially available cell. It will be seen that these characteristics are very similar to the plate current/plate voltage curves of a triode tube.

A curve representing a maximum cell dissipation of one watt has been drawn on the characteristics of fig. 1, together with two load lines (a) and (b). These load lines may be constructed in the same manner as those for a triode tube. With load line (a) the dissipation of the cell is below the 1 watt maximum with both 0.1 foot candles and 100 foot candles light intensity, but as the light changes from one of these levels to the other the dissipation rises to a maximum of 1.35 watts and is well beyond the permitted rating. If the frequency with which the light changes from one level to the other is low enough to prevent the mean dissipation from rising above 1 watt, this operating

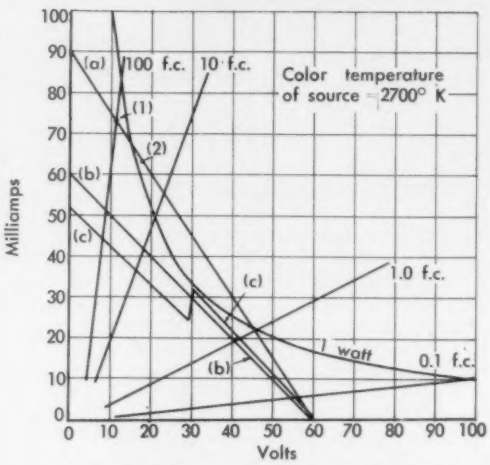


Fig. 1. Typical characteristic curves of CdS cells

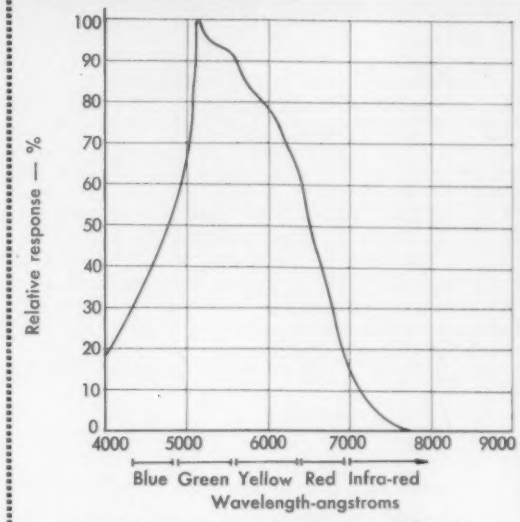


Fig. 2. Typical spectral response of CdS cell

condition should be satisfactory.

Unfortunately the light output of lamps varies with age and is subject to considerable reduction because of the accumulation of dust on lens and reflector surfaces. Unless these factors can be controlled it would be advisable to choose such an operating condition because the static working point (1) could easily move to point (2) on load line (a) as the light level deteriorates.

In those applications where the intensity of light is changing slowly it is, of course, necessary to design the circuit so that the dissipation remains below the permitted maximum for any light value which may be encountered.

The spectral response of a typical cell is shown in Figure 2 and this indicates that the peak sensitivity is in the yellow-red region. These cells are, therefore, particularly suitable for use with an incandescent lamp source.

The response time is generally much longer than that of most other photo-devices and is not the same when illumination is increasing as it is for a decreasing illumination. Figure 3 shows that it can take 100 milliseconds for the cell conductance to fall by 80% when an initial light value of 1 foot candle is suddenly cut off. The response time can be significantly shortened by using a higher level of illumination, consequently in those counter applications where a slow response time cannot be tolerated it is necessary to use an intense light source.

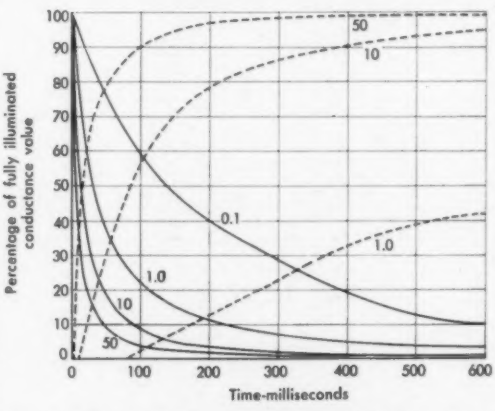


Fig. 3. Characteristics of CdS cells. Solid lines show rate of fall of conductance for different initial light values. Dotted lines show rate of increase of conductance for different final light values. The light values are in foot candles.

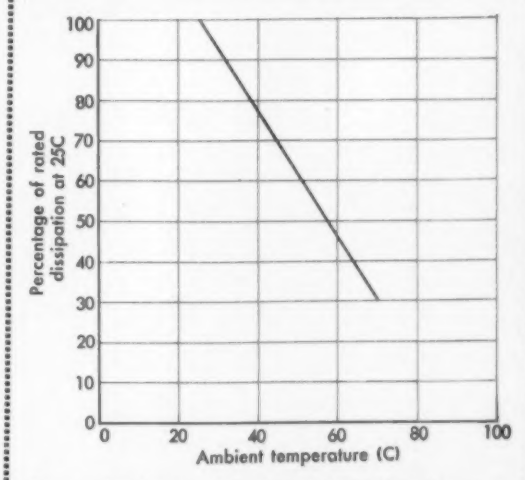


Fig. 4. Dissipation de-rating with ambient temperature of a typical cadmium sulphide photocell.

Cadmium sulphide photocells

The temperature rise of the resistive film of the cell must, of course, be limited to a safe value. Consequently the dissipation permitted in a particular cell is dependent upon the ambient temperature in which it is working and upon the physical shape and size of the cell and the efficiency with which heat is carried away from its resistive element. Cells differ widely in construction, some being flat plates covered with an epoxy resin and others consisting of an element mounted in an all-glass tube envelope which fully protects the cell from the effects of the atmosphere. Figure 4 shows a typical de-rating curve but manufacturers data should be consulted for each type of cell. In the case of cells of suitable construction considerable improvement in the de-rating requirements can be made by fitting a heat sink to the cell.

Like all resistive components, these cells have a temperature coefficient. It is dependent upon the level of illumination but is about +1% per deg C at low levels of light, and about +0.4% per deg C at high levels.

CdS photo-cells will operate on a-c or d-c.

Because the contacts to these cells are symmetrical and nonrectifying they can be used on a-c supplies and with a-c relays. Generally d-c relays are more sensitive than a-c relays, especially when a small number of light current contacts are to be operated, and when the greatest sensitivity is required d-c operation should be used. In circumstances where there is a large change in a high level of illumination a-c operation is practicable and the a-c relay may be used to operate a number of heavier current contacts.

In order to keep the cell dissipation low the resistance of the relay should be chosen so that it is small compared with the cell when minimum illumination is applied and large when maximum illumination is applied.

When a supply voltage has been selected (and this must be less than the peak voltage rating of the cell) a value of relay resistance can be chosen and a load line drawn on the characteristic curves as in Fig. 1. The choice must be made so that the illumination levels expected will produce the current necessary to operate and release the particular type of relay to be used. If a-c operation is to be used it must be remembered that there is usually a considerable change in relay impedance when the armature closes the air gap and consequently there is a sudden drop in relay current immediately after the relay closes followed by a change of slope of the load line. An example of this is shown in Fig. 1, load line (c).

In a-c operated circuits any tendency for the relay to chatter can be reduced by using a pair of relay contacts to short circuit a series resistor in the cell circuit, thereby increasing the relay current once the relay has closed.

A simple sensitivity control can be provided by placing a variable resistor in series with the cell.

Table 1 lists ratings and characteristics of some commercially available cells. **END**

Table 1

Type	Manufacturer	Maximum ratings			Characteristics at 25 deg C		
		Voltage dc volts	Power milli-watts	Ambient temperature range (deg. C)	Cell voltage	Illuminations sensitivity (microamps per foot candle)	Dark resistance (megohms)
6957	R.C.A.	250	500	−75 to +60	50	4000	2.5
7163	R.C.A.	250	300	−75 to +60	50	2000	1.25
7412	R.C.A.	200	200	+60 max.	12	300	120
ORP10	Philips	100	200	−40 to +70	10	1200	20
ORP30	Philips	350	1200	−40 to +70	10	6000	60
ORP90	Philips	350	1000	−40 to +70	10	2000	120
CDS-10	JEM Electronics	120	500	−50 to +75	100	2500	1-100
NSL-2	National Semi-Conductor (Canada)	300	500	−40 to +75	50	3500	40
NSL-3	National Semi-Conductor (Canada)	300	500	−40 to +75	50	4500	5
NSL-4	National Semi-Conductor (Canada)	300	500	−40 to +75	50	3500	1
NSL-5	National Semi-Conductor (Canada)	300	1000	−40 to +90	50	6500	40
NSL-6	National Semi-Conductor (Canada)	300	1000	−40 to +90	50	4200	5
NSL-7	National Semi-Conductor (Canada)	300	1000	−40 to +90	50	8000	1

MAURICE PRICE, P.ENG.*

Null sensitivities of three common potentiometer position servo arrangements are examined at all slider positions. Design charts are presented to give the least sensitivity in terms of the best sensitivity for any given set of component values. They also give the maximum servo loop gain variation as the potentiometer sliders are moved between their two extreme positions.

Sensitivity charts aid design of potentiometer position comparators

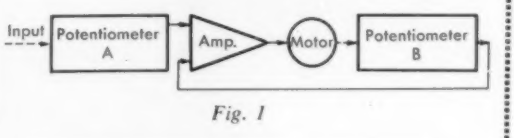


Fig. 1

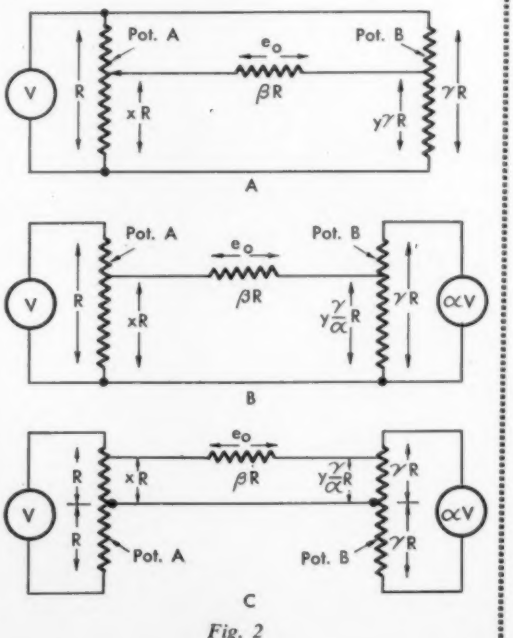


Fig. 2

A commonly used position servo is that employing potentiometers as the input and output comparison elements as shown in Fig. 1. Three typical configurations of the potentiometers are shown in Fig. 2.

The design of the servo is governed by the accuracy of follow-up, i.e., by the sensitivity of the system at the balance point. Due to the amplifier and motor threshold, this balance will be more or less broad. The balance width will vary with the position of the input potentiometer slider, owing to the finite input impedance of the amplifier.

It is the purpose of this paper to investigate the variation of potentiometer bridge sensitivity at the null and to establish the worst condition. The three configurations of Fig. 2 will be dealt with separately.

Symbols and procedure

The terminology will be evident from Fig. 2. Potentiometer A is at position x, while B is at position y, so chosen that at the balance point, $x = y$. All quantities are expressed relative to potentiometer A, measured in general from the common point of the two potentiometers. Note that the voltage parameter α need be considered only in the range $\alpha \geqq 1$, since values of $\alpha < 1$ can be accommodated merely by interchanging the potentiometers. The bridge sensitivity is defined as the rate of change of output voltage e_o with potentiometer position, x.

In all three cases, the best condition is when the sliders are at $x = y = 0$. This yields a sensitivity. essentially equal to that of potentiometer A alone,

*Central Dynamics Ltd., Pointe Claire, Que.

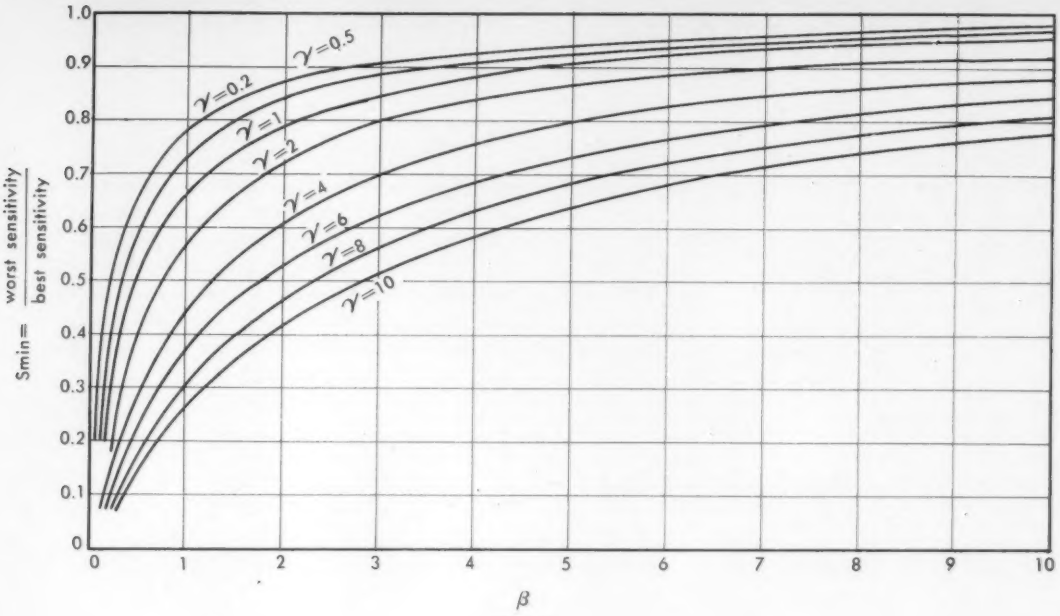


Fig. 3

and will be used as the criterion for comparison of sensitivities. At any combination of positions x and y, the sensitivity will be S, relative to the sensitivity S_o obtained when $x = y = 0$. The procedure for calculating the design charts is as follows:

(1) Compute the output voltage ratio e_o/V for any positions x and y.

(2) Derive the bridge sensitivity S_x from

$$S_x = \frac{\partial}{\partial x}\left(\frac{e_o}{V}\right) .$$

(3) Evaluate the sensitivity at null, S_n, by putting $y = x$.

(4) Find S_o, the best null sensitivity, by putting $x = 0$ in the expression for S_n. Express S_n as a fraction of S_o. This gives the relative sensitivity we desire, $S = S_n/S_o$.

(5) Examine the expression S for a minimum value, $S_{\min.}$, occurring at $x = x_{\min.}$.

(6) Present the results obtained in (5) in chart form.

Only the results of the calculations for these steps will be given, as the mathematics are elementary.

Case 1. (Fig. 2A)

$$(1)\ \frac{e_o}{V} = \frac{x - y}{1 + \frac{1}{\beta}[(x - x^2) + \gamma(y - y^2)]} .$$

$$(2)\ S_x = \frac{1+\frac{1}{\beta}(x-x^2)+\gamma(y-y^2)-\frac{1}{\beta}(x-y)(1-2x)}{\left[1+\frac{1}{\beta}\{(x-x^2)+\gamma(y-y^2)\}\right]^2} .$$

$$(3)\ S_n = \frac{1}{1 + \left(\frac{1+\gamma}{\beta}\right)(x - x^2)} .$$

(4) $S_o = 1$ at $x = 0$.

$$S = S_n/S_o = \frac{1}{1 + \left(\frac{1+\gamma}{\beta}\right)(x - x^2)} .$$

(5) $x_{\min.} = 0.5$.

$$S_{\min.} = \frac{1}{1 + \frac{(1+\gamma)}{4\beta}} \quad \text{at} \quad x = x_{\min.}$$

We see that the worst case is always at the centre position. The values of $S_{\min.}$ have been plotted in Fig. 3 for various values of β and γ.

Case 2. (Fig. 2B)

$$(1)\ \frac{e_o}{V} = \frac{x - y}{1 + \frac{1}{\beta}\left[(x - x^2) + \frac{\gamma}{\alpha}\left(y - \frac{y^2}{\alpha}\right)\right]} .$$

$$(2)\ S_x = \frac{1+\frac{1}{\beta}\left[(x-x^2)+\frac{\gamma}{\alpha}\left(y-\frac{y^2}{\alpha}\right)\right]-\frac{1}{\beta}(x-y)(1-2x)}{\left[1+\frac{1}{\beta}\left\{(x-x^2)+\frac{\gamma}{\alpha}\left(y-\frac{y^2}{\alpha}\right)\right\}\right]^2} .$$

$$(3)\ S_n = \frac{1}{1 + \frac{1}{\beta}\left[\left(1 + \frac{\gamma}{\alpha}\right)x - \left(1 + \frac{\gamma}{\alpha^2}\right)x^2\right]} .$$

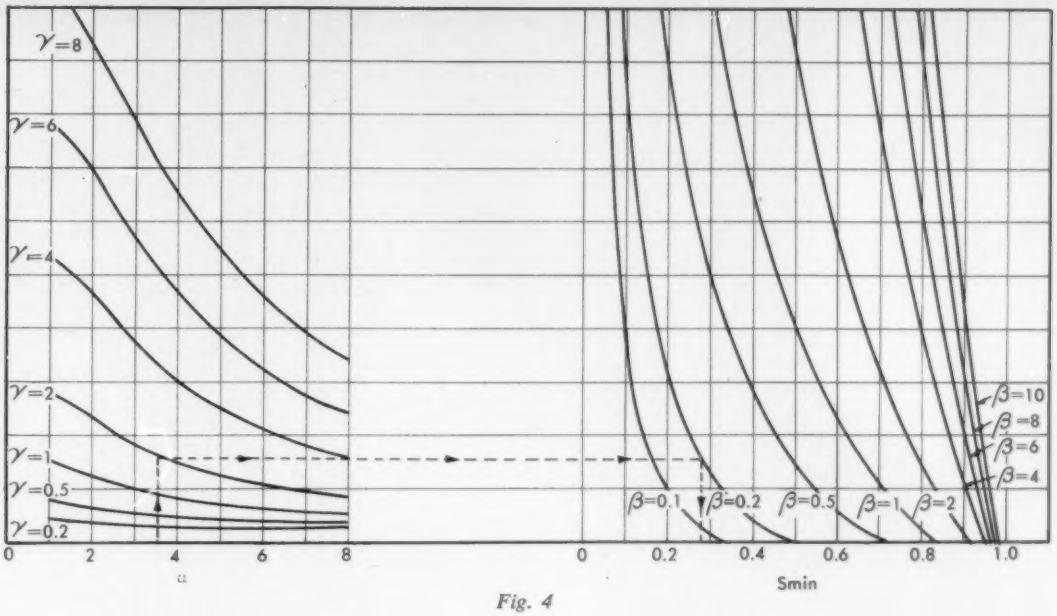


Fig. 4

(4) $S_o = 1$ at $x = 0$.

$$S = S_n/S_o = \frac{1}{1+\frac{1}{\beta}\left[\left(1+\frac{\gamma}{\alpha}\right)x-\left(1+\frac{\gamma}{\alpha^2}\right)x^2\right]}.$$

$$(5)\ x_{\min.} = \frac{1+\frac{\gamma}{\alpha}}{2\left(1+\frac{\gamma}{\alpha^2}\right)}.$$

If $x_{\min.} > 1$, the solution is physically unrealizable. This means that the worst practical condition is when $x = 1$, and we have:

$$S_{\min.} = \frac{1}{1+\frac{\gamma(\alpha-1)}{\alpha^2\beta}} \text{ at } x = 1.$$

If $x_{\min.} \leqq 1$, the worst condition is given by:

$$S_{\min.} = \frac{1}{1+\frac{1}{4\beta}\left[\frac{(\alpha+\gamma)^2}{\alpha^2+\gamma}\right]} \text{ at } x = x_{\min.}.$$

It can be shown that if $\gamma \leqq 8$, then $x_{\min.} \leqq 1$ for all values of α. This condition covers most practical cases, so that we need consider only the second expression for $S_{\min.}$, valid when $x_{\min.} \leqq 1$, for all values of α. The results are embodied in the curves of Fig. 4, which are accordingly valid for $\gamma \leqq 8$. To use this nomogram, enter the field at the appropriate value of voltage ratio α to meet the required γ curve. Then project horizontally to the desired β curve, and read off the value of $S_{\min.}$ on the abscissa. The dotted lines show a typical example.

Case 3. (Fig. 2C)

$$(1)\ \frac{e_o}{V} = \frac{x-y}{2+\frac{1}{\beta}\left[(2x-x^2)+\frac{\gamma}{\alpha}\left(2y-\frac{y^2}{\alpha}\right)\right]}.$$

$$(2)\ S_x = \frac{2+\frac{1}{\beta}\left[(2x-x^2)+\frac{\gamma}{\alpha}\left(2y-\frac{y^2}{\alpha}\right)\right]-\frac{2}{\beta}(x-y)(1-x)}{\left[2+\frac{1}{\beta}\left\{(2x-x^2)+\frac{\gamma}{\alpha}\left(2y-\frac{y^2}{\alpha}\right)\right\}\right]^2}$$

$$(3)\ S_n = \frac{1}{2+\frac{1}{\beta}\left[2\left(1+\frac{\gamma}{\alpha}\right)x-\left(1+\frac{\gamma}{\alpha^2}\right)x^2\right]}.$$

(4) $S_o = 0.5$ at $x = 0$.

$$S = S_n/S_o = \frac{1}{1+\frac{1}{\beta}\left[\left(1+\frac{\gamma}{\alpha}\right)x-\frac{1}{2}\left(1+\frac{\gamma}{\alpha^2}\right)x^2\right]}.$$

$$(5)\ x_{\min.} = \frac{1+\gamma/\alpha}{1+\gamma/\alpha^2}.$$

Since $\alpha \geqq 1$, $x_{\min.} \geqq 1$ and the solution is physically unrealizable for all α and γ. This means that the worst condition is always at $x = 1$, giving:

$$S_{\min.} = \frac{1}{1+\frac{1}{2\beta}\left[1+\frac{\gamma}{\alpha^2}(2\alpha-1)\right]} \text{ at } x = 1.$$

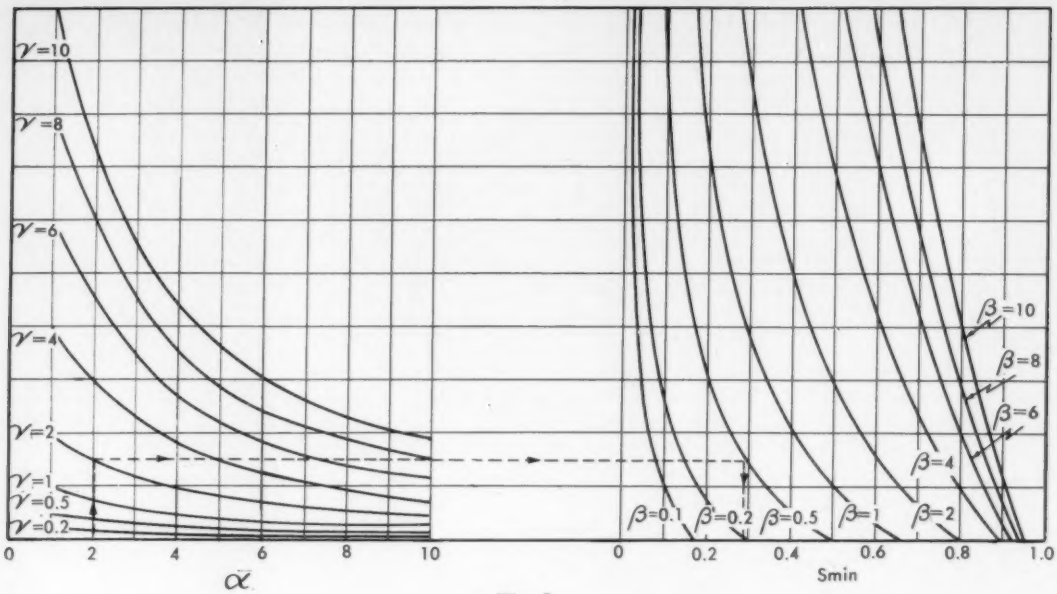


Fig. 5

This expression is presented in Fig. 5, valid this time for all γ. The curves are applied in the same way as those of Fig. 4.

Example 1

A position servo is set up according to Fig. 2C. The component values are as follows:

Potentiometer A: 10,000 ohms total
Potentiometer B: 20,000 ohms total
Supply to A: 100 volts
Supply to B: 200 volts

Amplifier input impedance: 2,500 ohms.

The amplifier sensitivity is such that the best discrimination of position possible is one turn of wire of potentiometer A. This condition is achieved when the slider of A is at the centre-tap. We need to know how wide the dead zone will be under the worst condition.

The applicable quantities are: $\alpha = 2, \beta = 0.5, \gamma = 2$.

This is a Case 3 problem, so that the worst condition occurs when slider A is at the extreme end of the potentiometer ($x = 1$). If the dotted lines of Fig. 5 are followed, we find that $S_{min.} = 0.29$. This means that the null width at the extreme of the potentiometer will be 1/0.29, or approx. 4 times the best condition. The dead zone will be about 8 wire turns wide, compared with only 2 turns in the best case.

Example 2

In example 1, to what value must the amplifier input impedance be increased so that the null width is not degraded to more than 4 wire turns?

The condition is that $S_{min.} \geqq 0.5$. We find from Fig. 5 that $\beta \geqq 1.4$ for this condition. The amplifier input impedance must be raised to 1.4(5,000) = 7,000 ohms at least.

Conclusion

The charts should prove useful in establishing quickly the worst design point for potentiometer voltage comparison servo systems. $S_{min.}$ is also an indication of the variation in servo loop gain from the most sensitive to the least sensitive state. Other uses will no doubt suggest themselves. END

Plan to attend

The 1959 IRE Canadian Convention & Exposition

October 7, 8, 9

Dear Sir:

I notice in the July issue of your magazine, on the editorial page, the statement that "Canadian manufacturers are being forced out of transistor production" by imports. This statement clearly implies that transistors are now being produced in this country.

Now, in five years of using transistors I have never seen a single one that I had any reason to believe was a 'made in Canada' item. If such things are available I am sure the people in Canada who use transistors would be interested to know more about it, as I would myself.

I might also suggest that pointing out Japan as the terrible example is somewhat invidious considering that Canada has what is called a favorable balance of trade with that country. Canada imports large numbers of electronic components from at least one country with which we have a very heavily adverse trade balance.

D. Parker,
Ottawa.

We need "sell" as well as "buy Canadian"

Reader's letter prompts transistor survey and some further comments

IAN R. DUTTON, ASSOCIATE EDITOR

During the past year the Electronics Industries Association of Canada has been conducting a campaign urging its members to buy "made-in-Canada" products. This has been aimed primarily at design engineers and purchasing agents within the electronics industry, and the people who stand to gain most from it are manufacturers of components and instruments.

Now EIA is entering phase two of its campaign. Appliance dealers and salesmen will be encouraged to promote the sale of Canadian-made radios and tv sets. EIA also has some vague hope that it can persuade the general public to pay a little more for a home-grown product and so preserve jobs that pay for groceries, that let grocers buy more Canadian-made radios, that preserve jobs, that . . .

The cold hard facts of the case are very much against the success of phase two, but it is worth a try. The home entertainment section of the electronics industry is facing serious competition and if it cannot meet the challenge then we are in danger of losing the major section of our industry. And if the radio manufacturers close down, most of the component manufacturers will too.

The industry has every reason to be concerned, but is the proper remedy being prescribed?

EIA has not succeeded internally with its "buy Canadian" campaign, and it has almost completely overlooked one very important phase of the program.

We have not noticed any appreciable change in buying habits among engineers and purchasing agents in our industry. Operating characteristics, price, delivery and familiarity still outweigh patriotism. But when someone does try to be patriotic the industry frequently lets him down.

Within recent months we have heard comments to the effect that engineers can't always tell when a product is made in Canada, or when it is imported.

Mr. Parker has been caught in the confusion so we telephoned representatives from 17 companies to get an answer on transistor production for him.

At the present time only two companies are making transistors here. Northern Electric Co. Ltd. is producing alloyed germanium and diffused silicon types for use in their own communications equipment. They grow their crystals and have done quite a bit of development work. Part of this has been described by Olaf Stavik in his paper, "Alloyed germanium transistor has symmetrical characteristics," CEE, November 1958, page 28.

RCA Victor Co. Ltd. is making about 15 different types of transistor at Montreal. They are being sold commercially and include types 2N217, 2N270, 2N406, 2N398, and others for use primarily in consumer products. At present the crystals are being imported, but the company intends to undertake all phases of production later.

Canadian General Electric Co. Ltd. has produced transistors on a limited scale to gain manufacturing experience. They are not producing them now, though.

To the best of our knowledge, no other company is making transistors in Canada, though some are making other semiconductor devices, and some are watching the market very closely.

As Mr. Parker has pointed out, it is invidious to use Japan as the terrible example. But if any "protective" action is to be taken, or sought, it should be based on avoiding sudden change in the industry. Rapid change causes turmoil and hardship, while gradual evolution usually is acceptable and healthy.

Why should the "buy Canadian" campaign stay within the boundaries of Canada? Why does the industry not try to sell its products abroad, particularly in the United States? Is it because we are awed by our big neighbor? It is because so many of our companies have American parents? Are our production costs too high, or are our products not worth placing in competition with those of United States and Japan?

Only when our industry stops "following" and begins to do some real research, will it be able to cope with competition in a positive way. That should be the third phase of the "buy Canadian" campaign, and it should be put in motion right away. END

R. W. Watler, P.Eng., assistant general manager of Muirhead Instruments Limited—with some new Canadian products.

Company profile

Muirhead Instruments Limited

IAN R. DUTTON, ASSOCIATE EDITOR

During the Korean War and the years immediately following, Canada's three Armed Services were engaged in a major modernization program. The World War II equipment which had been in use was obsolete and becoming uneconomical to repair.

The RCAF was equipping its squadrons with new aircraft and co-operating in the installation of large ground radar warning systems. The Royal Canadian Navy was going through a major rearmament program in which some of the equipment was similar to designs adopted by the Royal Navy.

In connection with these programs, the Canadian Government expressed a keen desire to have the equipment built in Canada. While relatively little direct assistance was given, verbal encouragement and information were extended to any manufacturer showing an interest in setting up shop here.

And Canada did not have any company manufacturing precision magslips and synchros.

With that general business atmosphere prevailing, Muirhead & Co. Limited of Beckenham, England, decided to establish manufacturing facilities in Canada. A new company, Muirhead Instruments Limited, was incorporated in 1954 and started producing synchros in rented quarters at Stratford, Ontario.

They began in a modest way, assembling synchros and servomotors from parts brought in from England. As soon as production equipment and skilled operators could be obtained and trained, however, the parts were manufactured at Stratford. Now the company is completely equipped to make all the basic components and parts for its line of synchros, servomotors and other electromechanical products.

At the end of 1955 Muirhead Instruments Ltd. moved into its new 17,500-square-foot factory on the outskirts of Stratford. The building had been designed specifically for their type of operation, with a machine shop, general assembly area, and temperature-controlled rooms for precise work.

Employees have been recruited in Canada

The total staff is approximately 80, including production and office personnel. All have been recruited in Canada except three executives. A. J. Muirhead, vice-president and general manager, personally launched the Canadian company and guided it up to its present position. R. W. Watler, assistant general manager, moved to Canada two years ago to help in the administration of the growing company. The third member from England is N. G. Arkell, projects manager.

F. E. Lyons, a former Muirhead employee who had come to Canada on his own initiative a few years earlier,

Electrical characteristics of all synchros are tested to ensure they meet the applicable military specifications

Deft fingers are needed to insert tiny pre-formed coils of 43 AWG wire into the stator of a number 10 servomotor

rejoined his former associates when the Canadian company was formed. He now holds the position of production manager.

With this experienced nucleus, Muirhead Instruments has been able to build up a competent group of production and design people capable of maintaining the quality established by its British associates.

The company manufactures an extensive line of synchros, servomotors, linear variometers, and tachometers. They range in frame size from 23 down to 08, and the majority are manufactured to Bu-Ord, NATO or British military specifications.

Some of the synchros and motors are designed to such close tolerances that the machining and inspection have to be done in temperature-controlled rooms.

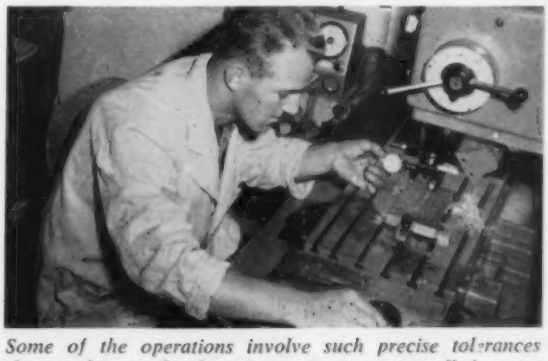
Other products include wave analyzers, frequency analyzers, decade oscillators, capacitance bridges, servo amplifiers, and other types of precision measuring equipment. They also make equipment for transmission of pictures.

While not all of this is manufactured in Canada, the "made in Canada" list is growing. As the sales volume increases for any particular product, limited assembly, then complete manufacture is undertaken at Stratford.

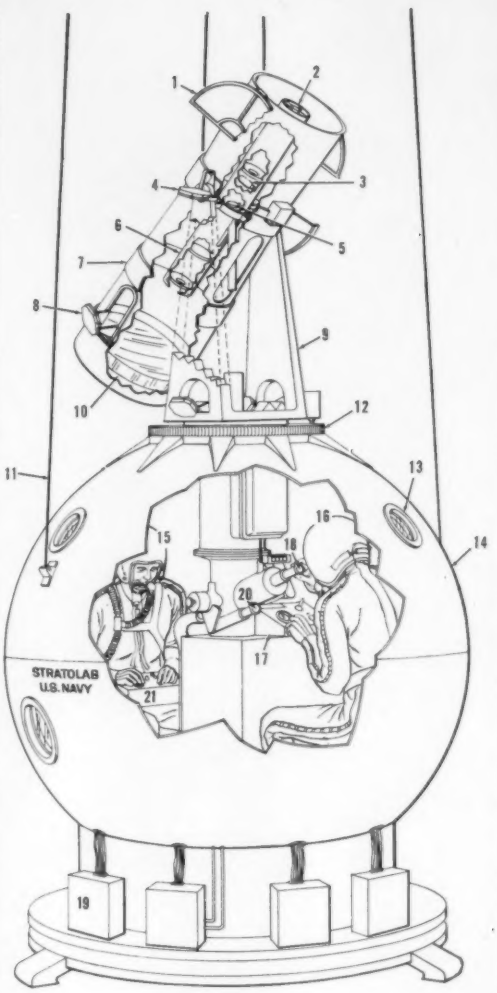
One example of this is the manufacture of electro-sensitive paper. When the Department of Transport established its system for transmitting weather maps by wire, Muirhead began manufacturing the paper in Canada.

Company officials have displayed a marked faith in their future role in Canada. Last year they established a project department to design and develop new and specialized equipment. Also through their associated American company they are selling Canadian-made products in the United States. END

Project section, opened in 1958, is responsible for the design of new products and handling of special projects



Some of the operations involve such precise tolerances that work must be done in temperature-controlled rooms



1. SUN FILTER
2. STAR TRACKER (CASSEGRAIN TELESCOPE)
3. STAR TRACKER IMAGE SENSOR
4. ACQUISITION MIRROR #2
5. MONOCENTER MIRROR
6. RELAY TELESCOPE
7. 16" SCHMIDT TELESCOPE
8. ACQUISITION MIRROR #1
9. TELESCOPE MOUNT
10. 16" SCHMIDT PRIMARY MIRROR
11. SUPPORTING SHROUDS
12. AZIMUTH DRIVE
13. OBSERVATION PORT
14. 7' GONDOLA
15. BALLOONIST
16. ASTROPHYSICIST
17. CONTROL PANEL
18. TARGET EYEPIECE
19. BATTERIES
20. ACQUISITION EYEPIECE
21. COARSE CONTROL PANEL

A classic problem...

How to mount a telescope on a balloon

Last year the United States Navy initiated a series of balloon flights to try and learn more about the universe. One flight took two scientists and a telescope some 15 miles above the earth to study Mars. Specifically, they wanted to collect data on the water vapor content of Mars' atmosphere. They could not do it from an observation post at ground level because Earth's atmosphere filters out much of the radiation. But at 80,000 ft. scientists could make spectroscopic measurements without local interference.

But just imagine the problem of providing a stable platform for a telescope mounted on a free-swinging gondola hanging underneath a balloon. In this case the telescope was just about as heavy as the gondola.

A solution was proposed by Dr. John Strong of Johns Hopkins University. A small telescope mounted inside the large telescope was used to look very precisely at what the big one was seeing generally.

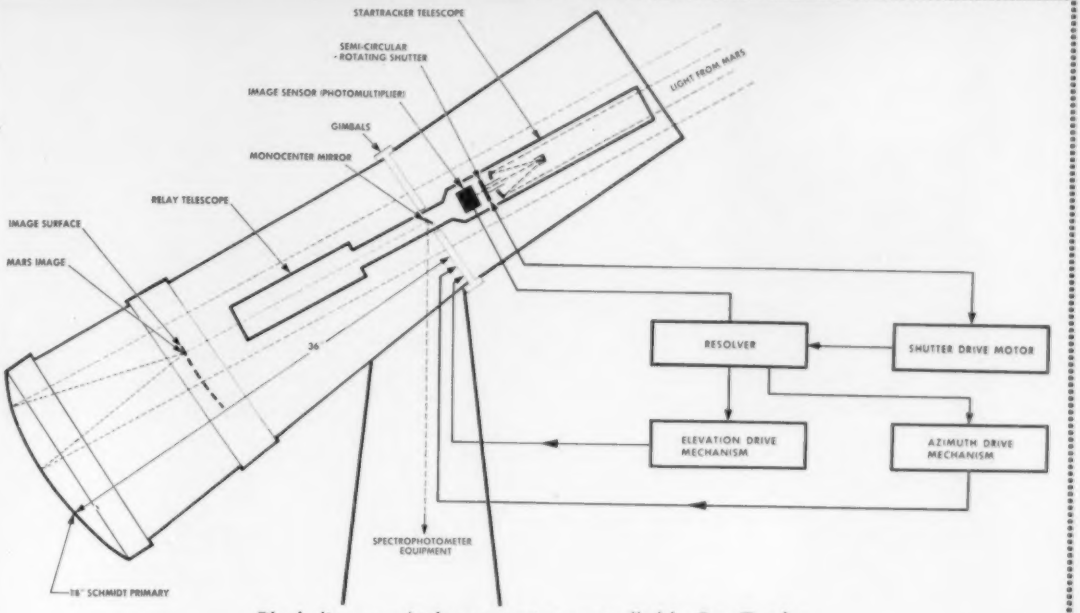
The entire viewing system consisted of two telescopes —the large 16-in. reflecting telescope with an 18-in. focal length, and a small 3-in. diameter Cassegrain telescope centred in the forward end of the large telescope's barrel. A relay telescope was pointed down the barrel toward the reflecting mirror of the large telescope.

To keep the image of Mars positioned on the half millimeter wide slit of the spectrometer, the Schmidt telescope had only to maintain Mars within its 3 deg. field of view. The Star Tracker controlled optics then held the image of Mars on the spectrometer slit to within one second of arc. This was possible because the spherical image surface generated by the 16-in. primary mirror was exactly concentric with the surface of the mirror. The centre of curvature of both the mirror surface and coincident image surface was defined as the monocentre of the optical system.

A small relay telescope, located within the Schmidt telescope, pivoted about this monocentre. It was always aimed at the image of Mars as it appeared in the Schmidt image surface, and relayed the image to the monocentre from where the light was further reflected and focused on the aperture of the spectrometering system.

In this manner the image of Mars could always be

Based on information supplied by Librascope Inc., Glendale, California.



Block diagram of telescope system controlled by Star Tracker

transmitted to the slit precisely, no matter what its position on the Schmidt image surface. A tiny mirror at the monocentre had to be actuated to do that, but the precision of that actuation was easily accomplished since errors of angle caused vignetting rather than image motion.

Star Tracker kept the relay telescope in position

The small optical relaying system was locked on the image of Mars regardless of its position in the image surface, by the star tracking mechanism. The Star Tracker was mounted coaxially with the relay telescope with its light gathering and sensing elements pointed out toward space. As long as the tracker remained locked on the planet, the relay telescope was locked on the image generated by the Schmidt telescope.

Within the Star Tracker, light was focused by a Cassegrain telescope on a photomultiplier tube. A rotating semicircular shutter placed in front of the photomultiplier tube modulated the light so that when the image of Mars was not directly on the tube the light beam would be interrupted and an alternating voltage generated by the tube.

When the tracking telescope was aligned with Mars and the image fell directly on the centre of the tube, the tube received a constant quantity of light and a constant value of voltage was generated by the tube.

The motor, which rotated the semicircular shutter, also drove a resolver. The output of the photomultiplier tube was also fed to the resolver. In this manner, the resolver determined the position of the Mars image with respect to the optical axis.

The outputs of the resolver in elevation and azimuth components were fed to elevation and azimuth actuators which pivoted the tracking telescope about the monocentre and aligned the telescope with Mars.

In essence, the tracking mechanism was always trying to keep the image of Mars formed by the tracking telescope centred exactly on the axis of rotation of the 180 deg. sector shutter. Whenever the image was not so positioned, signals generated by the photomultiplier tube actuated elevation and azimuth drive mechanisms to position the telescope correctly.

Spectral images were recorded electronically

The scientists were interested primarily in obtaining spectroscopic measurements of the light reflected from the atmosphere around Mars to try and determine the water content. This involved measurements in the infrared region. The recent availability of electronic detectors, such as the photomultiplier and the gold-doped germanium phototransistor, sensitive in the infrared region to 8 microns, permitted the scientists to use electronic recording, rather than photographic recording.

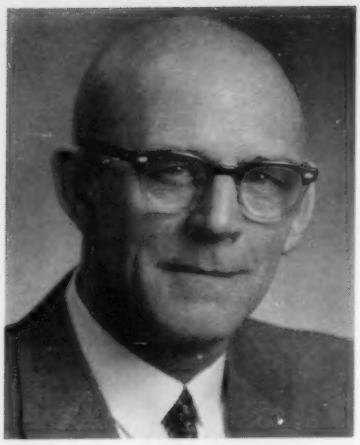
The information came out of a photocell to a conventional amplifier and strip chart recorder. The photocell itself was cooled by dry ice to enhance the signal to noise ratio.

There are a large number of water vapor absorption bands in the immediate vicinity of 11,300 Angstroms. In this installation, the exit slit of the spectrophotometer was replaced by a complex of 14 slits very carefully adjusted so that each would pick up a separate water vapor band. The light coming through the slits was then commonly collected by a single photomultiplier.

The spectrograph was a modified Ebert type employing three Farrand spherical mirrors and a mosaic of four plane gratings. The gratings were ruled at Johns Hopkins University on machines designed by Dr. Strong.

Several companies participated in the project

Johns Hopkins University held the prime contract for the design and construction of the telescope. Librascope, Inc., Glendale, Calif., designed the optical system of the telescope, and designed and built the Star Tracker telescope and electronic control system. Ferson Optical Co., Ocean Springs, Miss., built the Schmidt telescope to Librascope's design. Winzen Research, Inc., Minneapolis, Minn., built the balloon. Over-all supervision of the effort was exercised by Dr. John Strong of Johns Hopkins University.



Eric L. Palin
Administrative Assistant
Ryerson Institute of Technology
Toronto

General Chairman

David A. Golden
Deputy Minister
Department of Defence Production
Ottawa

Guest Speaker

1959 IRE Canadian Convention and Exposition

Meeting gains international recognition

The 1959 IRE Canadian Convention will be held in Toronto October 7, 8 and 9 in the Automotive Building, Exhibition Park. It will be the fourth annual Convention and Exposition sponsored by the Canadian Region of the Institute of Radio Engineers, and one of the largest scientific events in the Commonwealth.

One hundred and nineteen scientific and technical papers will be presented during the Convention, and over 300 exhibit units featuring electronic and nucleonic equipment and projects will make up the Exposition. A number of scientists from the United States and Europe will participate in the Technical Sessions; it is also hoped that some government scientific agencies from Europe will have exhibits in the Automotive Building.

On the first day of the 1959 Convention a Fall Executive Meeting of the IRE International will be held in Toronto. It will be followed on the second and third days by a Board Meeting of the organization. Twenty directors and officers, including the eight Regional Directors, are expected to participate in these executive sessions. A. P. H. Barclay, IRE Canadian Region Director is making arrangements for the Toronto meetings, which will result from the IRE International's acceptance of a long-standing invitation from the Canadian Convention Committees.

Eric L. Palin, chairman of the Executive Committee responsible for planning and organizing the Convention, announced recently that over 75% of the Exposition space has now been booked. A preliminary list of exhibitors appears at the end of this story. Information regarding remaining booth space can be obtained from the Convention Manager, Grant Smedmor, at 1819 Yonge Street, Toronto 7; telephones HUdson 8-7768, 1-3331 and 1-3332. He also disclosed details of the 25 Technical Sessions that will comprise the Technical Program. These will include sessions devoted to medical electronics, engineering management, communication systems and equipment, space electronics, solid state electronics and stereophonic broadcasting. There will also be a panel discussion on education and a session devoted entirely to papers presented by scientists from the National Research Council, Ottawa. The full time-table is given in the table opposite.

Professors from McGill and McMaster and the universities of British Columbia, Alberta and Toronto will form this year's panel on education. The hour-and-a-half discussion will be concerned with recent and projected changes in electrical engineering curricula at Canadian universities, and will centre on the need to broaden curricula to help students understand recent progress in solid state physics and other achievements of modern science.

Electronic traffic control in Toronto, the reliability of military electronic equipment, and the use of solar noise to calibrate radar systems will be the subjects of three of the papers to be presented during the Technical Program. Other papers will deal with fuel cells, frequency allocation problems, lunar space communications and the use of ionized meteor trails in microwave communications.

Morris Hales of the Ballistic Research Laboratory, Aberdeen Proving Ground, Maryland, will contribute one of the papers on military equipment reliability. Techniques of stereophonic broadcasting will be discussed by representatives of leading manufacturers of transmitting equipment and a member of the National Stereophonic Radio Committee of the United States. Representatives of Canada's Department of Transport and the Federal Communications Commission will present the papers on frequency allocation problems.

A new feature at the 1958 Convention was the Exhibit Award. This will again be presented to the exhibitor who

submits the best Canadian-designed component or equipment. Judging of entries will be carried out by a committee under the chairmanship of H. Ross Smyth, National Research Council.

As in previous years, the Convention Banquet will be held at the Royal York Hotel, Toronto on the evening of the second day. The guest speaker will be Dr. D. A. Golden, Deputy Minister of the Department of Defence Production, Ottawa. Mr. Golden's talk will cover various aspects of the U. S.-Canadian Production Sharing Program. The annual All Industry Cocktail Party will again be held on the Mezzanine of the Automotive Building on the Wednesday evening.

An additional feature of this year's program will be a series of Ladies' Activities. These events will include a City Tour of Toronto, a Scenic Historical Tour to Niagara Falls, Ontario, and a trip to view the Ontario Hydroelectric Power Commission's model of the St. Lawrence Seaway.

The staff of Canadian Electronics Engineering will once again be actively covering the Convention and Exposition, and look forward to renewing old and making new acquaintances in the industry. A warm welcome will also await callers at Booth 360.

Program Data

Dates	October 7 - 8 - 9, 1959.
Location	Automotive Building, Exhibition Park, Toronto.
Exhibit Hours	Wed., Oct. 7 — 10.00 a.m. to 6.00 p.m. Thur, Oct. 8 — 10.00 a.m. to 6.00 p.m. Fri., Oct. 9 — 10.00 a.m. to 8.30 p.m.
Technical Sessions	Wed., Oct. 7 — 2.30 p.m. to 5.00 p.m. Thur., Oct. 8—10.00 a.m. to 12.30 p.m. — 2.30 p.m. to 5.00 p.m. Fri., Oct. 9—10.00 a.m. to 12.30 p.m. — 2.30 p.m. to 5.00 p.m.
Registration	At the Convention building during exhibit hours. Fee is $1.00.
All Industry Cocktail Party	Wednesday, Oct. 7, 5 to 7 p.m. at the Convention building.
Convention Banquet	Thursday, Oct. 8, 7.30 p.m. at the Royal York Hotel.
Ladies' Headquarters	Royal York Hotel.

Convention Committee

Eric L. Palin	General Chairman
Ron. G. Bullock	Chairman, Social Activities
Herb. W. Jackson	Recording Secretary
R. M. Lynd	Chairman, Finance
Harry F. Shoemaker	Chairman, IRE Toronto Section
Ellerston Jones	Chairman,Advertising and Publicity
Fred J. Heath	Vice-Chairman
Don K. Ritchie	Chairman, Technical Program
Sid. F. Love	Exhibit Award Committee
George Armitage	Chairman, Exhibits
Lloyd M. Price	Chairman, Registration and Reception
H. Ross Smyth	Chairman, Exhibit Award
Grant Smedmor	Convention Manager
A. P. H. Barclay	IRE Canadian Region Director
Tom Purdy	Canadian Region Liaison
Dr. George Sinclair	Past-General Chairman

Technical program

DATE and TIME	SESSIONS				
Wednesday October 7 2.30 p.m. to 5.00 p.m.	TRANSISTOR APPLICATIONS	INSTRUMENTATION AND CONTROL	BROADCAST	RELIABILITY IN ELECTRONICS	RADAR
Thursday, October 8 10.00 a.m. to 12.30 p.m.	STEREOPHONIC BROADCASTING	SEMI-CONDUCTORS	AIR TRAFFIC CONTROL	MEDICAL ELECTRONICS I	ANTENNAS I
Thursday, October 8 2.30 p.m. to 5.00 p.m.	AUDIO	EDUCATION PANEL	SOLID STATE ELECTRONICS	MOBILE COMMUNICATIONS	ANTENNAS II
Friday, October 9 10.00 a.m. to 12.30 p.m.	SPACE ELECTRONICS	DESIGN METHODS	ANALOG COMPUTING	MEDICAL ELECTRONICS II	COMMUNICATION EQUIPMENT
Friday, October 9 2.30 p.m. to 5.00 p.m.	DEVELOPMENTS AT NATIONAL RESEARCH COUNCIL, OTTAWA	ENGINEERING MANAGEMENT	COMPONENTS FOR DIGITAL COMPUTERS	POWER SUPPLIES	COMMUNICATION SYSTEMS

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Atlas Polar Co. Ltd., Toronto E24
Atlas Radio Corp. Ltd., Toronto 344
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Bayly Engineering Ltd., Ajax, Ont. 247, 249
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Belden Mfg. Co., Chicago, Ill. 533
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Group Captain D. G. Keddie (seated), senior warning control officer of Civil Defence at St. Hubert, Quebec, and Lorne I. Newman, a representative of The Bell Telephone Company of Canada, discuss the installation of the new system

National attack warning system provides phone link for Canada's civil defence

Canada's civil defense organization now has a consolidated communications system stretching from St. John's, Nfld., to Victoria, B.C., as a result of circuits established by the communications organizations comprising the Trans-Canada Telephone System.

The new National Attack Warning System was turned over to civil defense authorities on April 1, following a field test of the equipment by civil defense and telephone personnel.

During the successful test, held on the day prior to the turn-over, Maj. Gen. George S. Hatton, deputy civil defense coordinator for Canada, tried out the system from his Ottawa headquarters and called it, "another milestone in our goal to have a well-built, sound and effective civil defense organization for Canada."

The network provides inter-communication between all 10 provincial capitals and 19 other major Canadian cities or target areas, as well as the five air defense command control centres in Canada. A single control officer can give or receive messages to all or any one of the 34 stations on the system.

In order to give maximum communication facilities at minimum cost, the telephone systems established the network so that existing long distance telephone circuits could be utilized when required. When not in use, they serve as regular long distance circuits.

"Such a system," General Hatton told civil defense coordinators throughout Canada during the final field test, "provides the equipment to permit us to flash a warning to you effectively and as rapidly as it unfolds to us."

Key centre for the 34-point network is at St. Hubert, Que., where the senior warning control officer works closely with air defense command headquarters. Any alert received by the base is immediately passed on to the civil defense officer who can then order the communications system energized by alerting The Bell Telephone Company of Canada at Ottawa.

Kept abreast of all new developments by the air defense command personnel at St. Hubert, the senior warning control officer can then report detailed information to the coordinators at the provincial capitals or direct to any other city on the network. In the event of a local attack or emergency the coordinator at any point can relay details back to the control centre at St. Hubert.

While 34 points were established on the network at the time of the turn-over, the facilities can be easily expanded to other centres virtually anywhere in Canada. END

Story and photographs supplied by The Bell Telephone Company of Canada, Montreal.

Maj.-Gen. Hatton speaks on coast-to-coast telephone link

Quantizer measures time within 20 light feet 142

To test equipment under conditions of high acceleration, the United States Air Force Air Research & Development Command uses rocket propelled sleds that can reach speeds almost four times the speed of sound. During the 30-second sled run, performance data is recorded on tape in digital form. The tape is played back later for detailed analysis.

To adequately evaluate sled performance it is necessary to measure time intervals very accurately. Utilizing a space-time quantizer developed by Computing Equipment Corporation of Los Angeles, the sled speed measuring equipment at Edwards Air Force Base will measure time to an accuracy of ± 20 millimicroseconds.

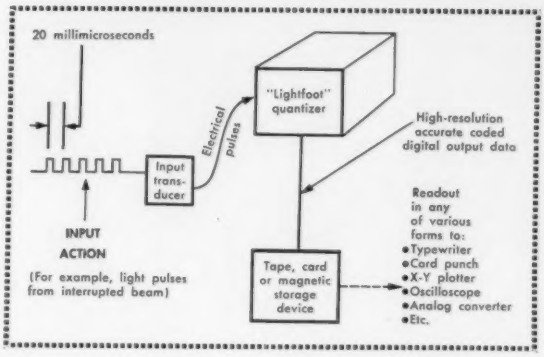
Since 1 light foot (the time required for light to travel 1 foot) is very nearly equal to 1 millimicrosecond, the equipment has been named a Light Foot Quantizer (LFQ).

A quantizer converts an input having a continuous range of values into an output with discrete values. While the conversion of an analogue signal into digital form may or may not involve the sampling of the input signal, it will involve quantizing. For this reason, the conversion unit is called a quantizer as distinct from a digitizer, which may combine sampling and quantizing.

The LFQ accepts, as its input, time intervals. These may be period-modulated pulse trains, frequency or phase-modulated sine waves, or pulse width modulated signals. The LFQ converts this into a digital number.

The rate at which these conversions are carried out is the reciprocal of the input interval, up to a maximum of 500 kc. The duration of the interval may be as long as required. In general, the conversion rate will be limited by the ability of auxiliary equipment to assimilate the data.

Previous quantizing equipments have used one of two methods: (1) A pulse train is gated by the interval to be quantized. The gated pulses are counted in a scaler and the digital number recorded is representative of the input interval. For a resolution of 20 light feet a unit of this sort would demand a 50-mc scaler in its first stage. (2) Coarse-fine vernier techniques may be used which are limited when continuous conversion is required and basically rely on analogue circuits and procedures.



The Computing Equipment Corp. LFQ system avoids the use of analogue techniques and relies on digital procedures. Counting circuits utilizing transistors need operate at only a fraction of the counting rate required in earlier systems. Solid state components establish the resolution accuracy, in contrast to basing the accuracy on counting circuits.

Test centres keep networks operating 143

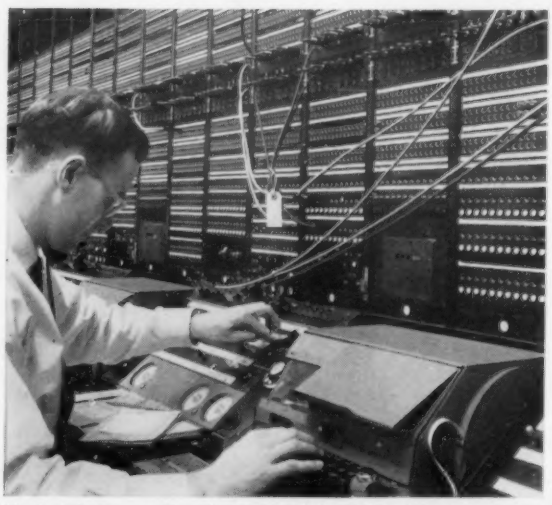
A new test and facilities board to increase the dependability and quality of teletype services was recently installed in the Bell Telephone Company's Adelaide Street building in Toronto. Known as a No. 2 test and facilities board, it is established in a Serving Test Centre (STC). STCs provide a rapid and flexible means of making sure customer facilities are working smoothly.

In Toronto one STC office maintains some 800 Bell teletype networks, another looks after about 1,200 private telephone line contracts (including special testing facilities for communications for a major pipeline), and a third has been established to deal with the transmission of CBC television programs.

These services impose rigid requirements of quality and reliability. Interruptions of only a few minutes can cause many problems for the customers.

When a customer reports difficulties the information, along with a circuit layout of the customer's network, is given to a technician who can begin tracing the difficulty and initiate corrective action when necessary.

These STC offices are established so that, on any network provided to a customer, one of the STCs will oversee the complete facilities provided on the network as well as handle reports made within its own territory.



Technicians on No. 2 test and facilities board can use teletype or telephone to help locate reported troubles

Plug-in tuner converts phonograph to radio 144

Seabreeze Manufacturing Limited unveiled its 1960 line of record players at a press conference in Toronto this month. One of the most interesting features, from the engineering point of view, is the fact that all of the new players can be converted into radio-phonograph combinations by the addition of Tune-A-Dyne transistor tuners.

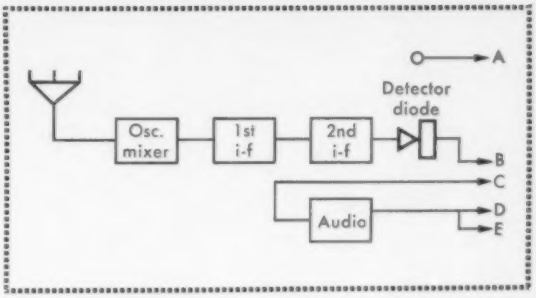
Each phonograph has a plastic "well" built into it. To convert to a radio, the cover is removed from the well and a Tune-A-Dyne inserted. This is a small am tuner measuring 1½ inches in diameter and 3 inches long. The weight is only 3 ounces for the complete assembly which includes an antenna, tuning capacitor, four transistors, diode detector, printed circuit board and other components.

The only control is the tuning capacitor. Volume is controlled in the phonograph amplifier, and if the tuner is pulled out about a quarter of an inch it will remain "off" while the record player is in operation.

Power to drive the tuner is derived from the cathode of the first audio stage in the amplifier of the phonograph. It is represented by point A on the drawing. The detected signal enters the amplifier at point B, then comes back into the tuner at C. Within the amplifier there is a resistor, the value of which depends upon the total gain available through the amplifier. This allows the same tuner to be used in all of the Seabreeze phonograph amplifiers.

After one stage of audio amplification the signal finally is fed to the amplifier through points D and E. One point only is used in monaural amplifiers, but both points are used to feed the signal to both channels of stereo systems.

In the photograph Arthur K. Tateishi, president of Seabreeze Manufacturing Ltd., is holding one of the Tune-A-Dynes with its cover removed to show the arrangement of the components. The tuning control mounts on the end of the cylindrical unit and is the only thing visible when the tuner is inserted into its "well" in the phonograph. Price of the tuners will be about $24.95.



New process almost grows finished transistors 145

A $2-million development contract in the field of molecular electronics has been awarded to Westinghouse Electric Corp. The contract was issued by the U.S. Air Research & Development Command's Wright Air Development Center as part of a broad program in this new area.

The development centres on a new method of growing germanium crystals as thin, uniform flat ribbons. Formerly, the raw product was round and about the size of a .50-calibre bullet. Tedious slicing and polishing of the material then followed (about 80% of the ingot was thrown away as germanium "sawdust").

Research now shows the material may be literally grown as thin, uniform flat ribbons.

Results to date indicate that the method may lead to the development of electronic equipment 1,000 times smaller and lighter than anything now in existence.

The material grows directly in the exact form in which this semiconducting material is used for practical purposes in transistors and similar devices. The molecular concept is a basically new approach to the building of electronic systems. It deals with dimensions comparable to molecules themselves and is not just an improved method of packaging present-day components.

Dendritic germanium presents many new possibilities. The process could work in a machine that continuously, automatically, and at high speed turns out finished transistors directly from an input of raw germanium and the two or three other materials required to put a transistor into final form.

Photorectifiers extend computer capabilities 146

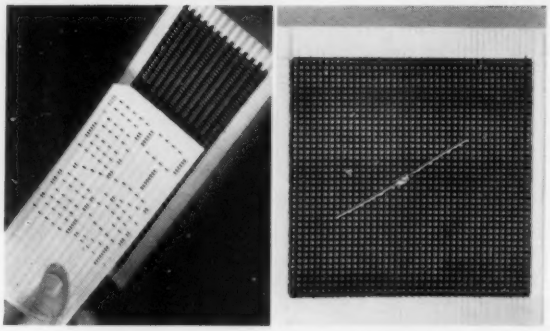
A deceptively simple looking glass-like plate only 4 x 8 inches is bidding to bring the advantages of electronic computers within the reach of many new users and to help extend the capabilities of some systems now in use.

Called photorectifier plates, the units are a development of MIT's Lincoln Laboratory and will be marketed by Rex Corp. of West Acton, Mass. under the trade name Rex-Arrays. The plates are applicable to existing digital computers as well as new units. They can be used in conjunction with any punched card system replacing mechanical methods of film reading, card reading, character recognition — even language translation.

The significance of a Rex-Array lies in the fact that it greatly extends the range and increases the flexibility of digital computer systems by behaving essentially like an array of diodes — with several important differences.

A single Rex-Array is equivalent to a large conventional diode network, yet requires practically no soldering and utilizes up to one twentieth the space. Packing densities of 100 "light cells" per square inch are being manufactured now but much higher packing densities are possible. In addition, while photo diodes have diode characteristics whether illuminated or not, photorectifiers operate only when illuminated. This advantage enables activation of required networks by simple masking techniques.

This means that a computer designed to do production control can be adapted to inventory control simply by changing the mask, not the array. Card and film readers, mathematical table storage — even such things as language translation are now possible with general-purpose computers. While many of these applications have been theoretically possible before, their implementation was too bulky, too costly (with hand soldering of individual diodes) or impractical for other reasons.



The photograph on the left shows a Rex-Array with a conventional punched card. On the right is another Rex-Array forming a background for a light-sensitive diode. This shows the marked reduction in size that can be achieved with the photorectifier plates.

Character-reading machine helps study itself 147

The U.S. Air Force Air Research & Development Command has developed a new information machine which reads typewritten pages and translates them into electrical signals at the rate of 200 characters per second. The new machine was developed by the Intelligent Machines Research Division of Farrington Manufacturing Company, Arlington, Va., and is called the Print Reader MX-2021.

The machine reads ordinary typewritten sheets having both upper and lower case alphabetical characters; numerals which are self-checking for accuracy; and even reads the punctuation symbols.

As it scans a line at a time, it reads the information one character at a time, and upon identification, using stored electronic logic, it converts the information into electrical signals at the rate of 200 characters per second. It thereby provides the information in a form which avoids all subsequent manual handling in communications, indexing, abstracting, and other information-processing problems necessary to the Air Force and other government agencies. The Air Force interest in the Print Reader centres upon a never-ending maintenance of millions of pages of information which must be processed before being used. All technical information must be indexed and abstracted so scientists will know the information exists and locate the information when they need it.

While machines already have been used to translate, index, abstract and retrieve information, the original data have always been entered by keyboard operators manually. Now the Print Reader performs this heretofore tedious operation almost instantaneously and accurately, and relieves manpower for more important tasks required in information data-handling within the Air Force. With only thirty of these machines, it is possible to automatically read and process information at ten million pages a year.

Of particular significance is use of the MX-2021 as a research tool for its own development and learning of its reading logic. There is a considerable amount of research still required for universal use of print reading machines. The Air Force's reading machine at the present can only read one type style; however, research is continuing and promises to achieve reading all type styles in the very near future.

The MX-2021 uses a scanner to produce tv-like video impulses from the typewritten characters on a page, and then analyses the video pattern for various identification clues. Unlike most other electronic machines, this one can ask itself a question, that is, test for identification clues, continuously and simultaneously. This enables the Print Reader, after answering yes or no to a few of its own questions, to make a very sophisticated analysis in identifying the pattern.

While processing characters at a rate of 200 per second, the reader translates information into electrical signals for further machine processing. The output can be punched paper tape, punched cards, magnetic tape or fed directly into electronic computers.

Digital computer solves navigation problems 148

Librascope, Inc. has developed a lightweight, multi-functional, digital computer for the Weapons Guidance Laboratory, Wright Air Development Center. The AN/ASN-24 can serve as the prime module for military and commercial airborne navigation systems. It handles data from TACAN, celestial, inertial and Doppler information, radio, true airspeed systems and heading instruments, in one 32-lb computer unit.

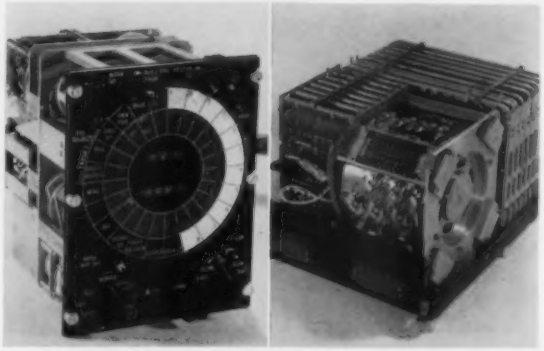
The AN/ASN-24 is a two-address, serial, binary data computer with digital impulses stored as 25-bit words on a 6,000 rpm memory drum. The drum has 32 channels, each one holding 64 words, which provides a total storage of 2,048 words.

Incoming analog information is converted into digital information. Outputs of latitude and longitude are shown on the main control console, and range and bearing information is displayed on the face of the range-bearing indicator.

The pilot or operator may manually introduce additional data into the computer by merely setting two knobs on the front of the control console to the desired values and then pressing a "set" button. The data will remain on the drum until changed by the operator or by reprogramming on the ground.

To obtain information, such as distance and bearing to a desired destination, the operator may select a choice of four destinations for which latitude and longitude have already been programmed, or manually insert the position of an alternate destination.

The computer provides aircraft position at any particular time from dead-reckoning, navigation ground systems, celestial fixes, or any combination of these. A credibility criteria programmed into the memory permits the computer to select the "best" input information from the sensors. Data obtained from the various sensors is carefully "weighted" to provide maximum accuracy in the computed results. The digital computer will continuously subject itself to test problems designed to determine whether it is functioning properly.



Wind computation, both in direction and in velocity, is made automatically. Magnetic variation correction to magnetic heading information is also done automatically. Photo mapping and reconnaisance control computations can be programmed.

Intercept courses to a moving target may be computed and the operator given a choice of pursuit or collision bearings.

The control console, shown in the left photograph, displays latitude and longitude information. On the right is the computer with the magnetic memory storage drum shown in the foreground. The unit occupies 0.55 cubic feet.

Librascope, Inc. is represented in Canada by Canadian Applied Research Ltd., Toronto.

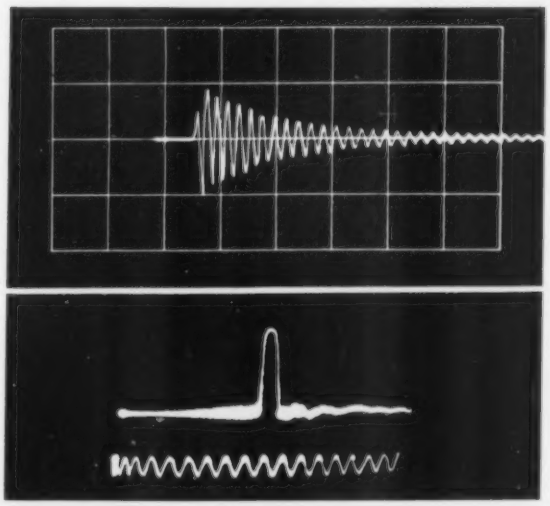
New high-speed film can see what you can't 149

The Polaroid Corporation has developed (if you will pardon the expression) a high speed film that can be used to record single cro transients with rise times less than one millimicrosecond. Rated as ASA daylight exposure index of 3000, this film fits any of the standard oscilloscope cameras with Polaroid Land Camera backs for use with 5-inch crt's.

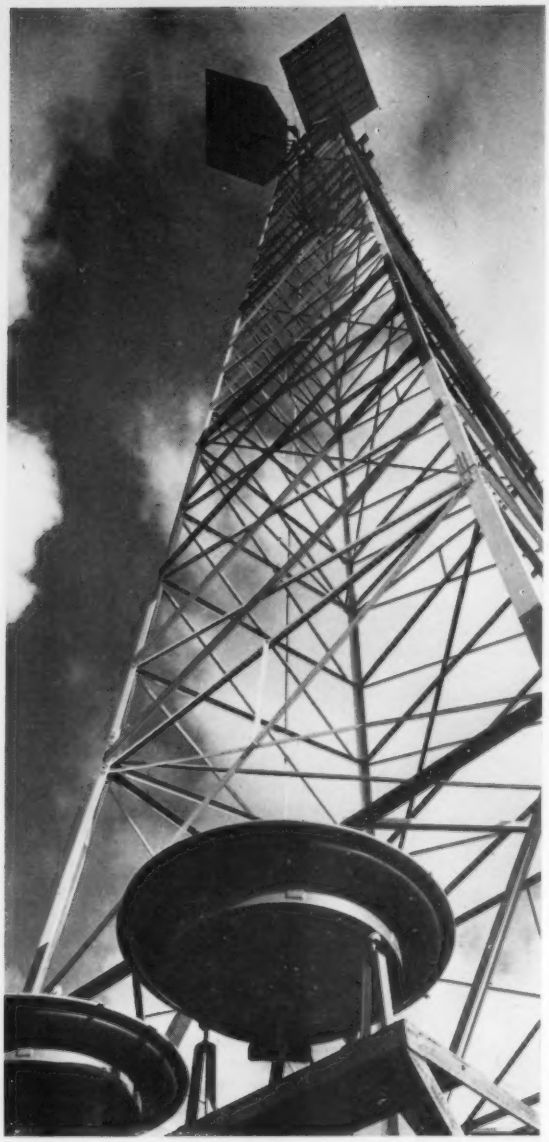
With this new film, designated type 47, transients can be recorded of such high speed that they are invisible to the eye. The upper photograph shows a single shot 450 mc damped sine wave. A measurement of the fastest visible part of the trace indicates a writing rate of over 3000 cm per microsecond. The trace was displayed on a Tektronix 517A oscilloscope and recorded with a Hewlett-Packard 196A camera set at f/1.9.

Even higher trace speeds of over 4000 cm per microsecond can be recorded with this film when development time is reduced to the 20 to 30 seconds permissible for trace recording. Although a full minute development is needed for general pictorial use, 20 seconds is recommended for cro trace recording to increase the maximum writing rate and to speed up the picture taking process. With special prefogging techniques it is possible to work at writing rates exceeding 8,000 cm per miscrosecond.

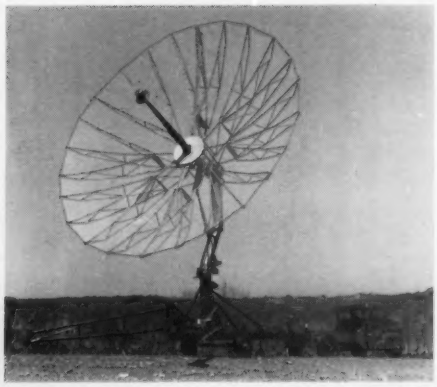
The lower photograph is a record of a single pulse slightly less than one millimicrosecond wide. A rise time of a few tenths of a millimicrosecond can be seen on this picture. This single transient was not visible to the eye. The calibrating sine wave is 500 mc.

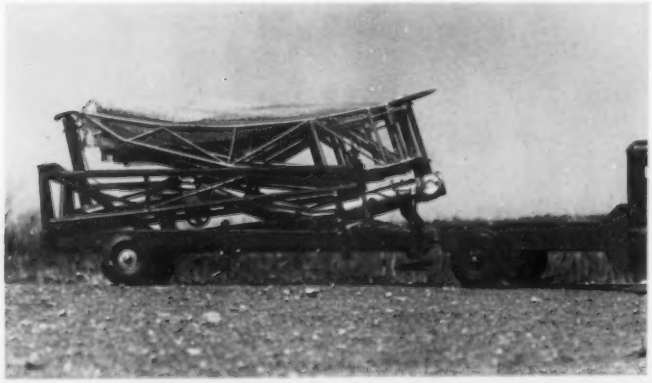


Antenna designs show close link between mechanical engineering and electronics



Tower at left, built by Blaw-Knox Co. for Rochester Telephone Corp., is 125 feet high and self supporting. Parabolic antennas with curved hook feed at base direct microwaves in 5995-6415 mc band to reflectors at the top of tower. Collins Radio Co. antenna type 137Y-1, above, is used with doppler radar navigation system. Three beams in X-band are directed down from aircraft and frequency shift of the reflected signal measured.





Transportable tracker, designed by D. S. Kennedy & Co., uses a special reflective cloth on the 28-foot diameter reflector so that the assembly can be folded down on the self-contained trailer mount and towed to a new site. The elevation and azimuth drives are designed for operation by hand, but motors and selsyns can be added for automatic tracking.

BJ Electronics is building these radio direction finder-recorders for U. S. Army Signal Corps. They are part of Rawin sonde system which provides meteorological data.

New radar designed by MIT's Lincoln Laboratory uses 50 ton antenna 120 ft. wide and 31 ft. high. It can be rotated 5 rpm in 60 mph wind and maintain accuracy of 1/10 deg.

Equatorially-mounted, 85-foot radio telescope built by Blaw-Knox Co. for University of Michigan Observatory, has solid surface but can withstand winds up to 120 mph.

Transportable ssb communication station, designed by Collins Radio Co. for U. S. Army weighs less than 2,000 lbs and can be set up for operation within 30 minutes.

For your library

World radio handbook gives data on all broadcasting stations

World Radio Handbook

Published and edited by O. Lund Johansen, Lindorffsalle 1, Hellerup, Copenhagen, Denmark; 186 pp; $2.50.

People in North America, being somewhat isolated geographically and well supplied with domestic radio and tv programs, have not explored the interesting field of short-wave radio. Nor have they taken a look at the wealth of fine programs offered on standard broadcast or tv frequencies from other countries around the world. If they knew what they were missing they would probably persuade the major broadcasting networks to import some of the programs, particularly tv programs.

The World Radio Handbook is an interesting collection of information about broadcasting (both radio and tv) stations throughout the world. For each country, the book lists radio stations, frequencies, powers, locations and call letters. In addition, there are several short sections in the book with interesting facts and information to help the reader understand more about the subject. In this respect, the display advertisements complement the book very well. They appear to have been designed specifically for this book and the people who read it.

Even if you do not own a short-wave receiver, this annual listeners guide will provide interesting reading. It is an education in itself reading about the work of people in other countries throughout the world.

Project Sherwood—The U. S. Program in Controlled Fusion

Amasa S. Bishop; (Addison-Wesley Publishing Co., Inc.) Thomas Allen Ltd., Toronto; 216pp; $5.75.

While the subject of controlled thermonuclear fusion came into public view only recently, scientists have been working on it for several years. This book is an account of the work carried out by the United States Atomic Energy Commission during the period 1951 to 1958.

Mr. Bishop enters the subject with a clear, concise explanation of the atomic physics involved in fusion. Then, in chronological order, he describes the various methods tried by research groups in the quest for controlled fusion. Methods such as the pinch, stellarator, magnetic mirror and molecular ion ignition are explained, along with a very good account of how each idea came into existance and the problems that were encountered.

Controlled fusion could become a very important science in the near future. Since the techniques are primarily those employed in electronics, it is a subject that should be understood by engineers in the latter field.

For a clear presentation on the basic principles of thermonuclear fusion, this is the best book encountered to date. It has been written so that people with little technical training can understand the subject. At the same time, those with more training will derive more benefit from the book. The illustrations are far superior to those published in most books or journals. Color has been used to good advantage in presenting the ideas in a form that is easily understood. Anyone entering the field of fusion would do well to start with this book.

The Use of Isotopes: Industrial Use

Volume 19 of the proceedings of the second United Nations internation conference in Geneva, September 1958. Available from local bookstores or United Nations, Sales Section (PUAE, Room 814) New York, N.Y.; 366 pp; $12.50 (U. S.)

This is a collection of more than 50 papers dealing with progress in the use of isotopes and the use of isotopes in industry. They represent experience gained through the use of isotopes in a wide variety of fields. Paper titles are: Recent uses of radioisotopes in Sweden; Applications of isotopes in research and control; Industrial applications of radioisotopes; Tracer techniques in Finnish industry; New applications of radioelements in France; Radioisotopes and high energy radiation in Japan; Non-destructive testing in Czechoslovakia; Applications of radioisotopes; Developments in industrial application of isotopes; The atomic triad; Medical value of radioisotope localization; New developments reported to the Conference; Solid-liquid interfaces and labeled surface layers; Use of activaiton in isotope techniques. Isotopes for checking thin-walled products; Isotopic fluorescent X-ray production and application; Nondestructive inspection in Japan; Engine wear measurement in moving vehicles; Action of anticorrosive additives; Radioisotope study of lubricant thickness; Industrial measuring equipment in Japan; Low energy photon sources in industry; Measurement of thin layers by backscattering; Radioisotopes in metallurgical research; Diffusion of elements in zirconium and titanium alloys; Advances in metallurgical research; Process analysis in the chemical and metal industries; Investigations of backscattered beta radiation; Determination of tungsten in steels by backscattering; Radiographic and radiometric study of metals; Phosphorus analysis in steel by isotope dilution; Inspecting the technology of continuous casting; Current efficiency in aluminium furnaces; The adsorption of tracers on mineral particles; Flotation studies with radiography and radiometry; Tracer study of antimony migration in a lead battery; Measurement and control methods using radiation; Continuous measuring of hydrogen in hydrocarbons; Rapid bacteriological detection and identification; Fission products as tracers in chemistry; Relay instruments using radioactive isotopes; Power from radioisotopes; A recording method for water-level fluctuations; Control and measurement of levels and densities; Flow measurement by the total-count method; Radiation in sanitary engineering; Investigations into conveying of fine coal; Radioactive tracers in oil extraction in Romania; Tracing beach sand movement with radioactive sand; Tracing undersea sand movement with radioactive silver; A suitable tritium carrier for gas discharge tubes.

Technical Societies Guide

Compiled by the Technical Societies Committee of the Industrial Publicity Association, Room 1616, 41 East 42 St., New York 17, N.Y.; 32 pp; $3.00 (U.S.A.).

This is a reference manual of procedures required by technical societies and trade associations for presentation and preparation of technical papers and publicity.

Prepared in co-operation with 36 leading technical societies, the guide contains data on: membership structure, number of members, principal meeting dates, subjects of interest, paper requirements, mechanics of contribution, policies on preprints and reprints, restrictions and rights to papers and data on each society's publication and publicity policy.

Included in a special section for authors are suggestions regarding the content of papers, fundamentals of oral presentation and preparation of visual aids as well as information on the preparation of the manuscript for submission to the editors of society publications.

Fundamentals of Radio Telemetry

Marvin Tepper; (John F. Rider Publisher, Inc.); Charles W. Pointon Ltd., Toronto; 144 pp; $3.10

Telemetry is closely bound up with missile and aircraft development and with the coming conquest of outer space. It makes possible the collection of data on which the improvement of existing rockets, missiles and aircraft is based. This book introduces the reader to the field of radio telemetry, explains its purpose, and explores its techniques. Special sections are devoted to missile and satellite telemetry hardware, and to data recording as well as processing. Numerous block diagrams, pictorialized explanations, and photographs accompany the text.

PRD Reports

Quarterly reports available free contain technical papers on a variety of subjects such as "Waveguide sliding shorts, sliding terminations and standard mismatches" and "Waveguide rotary standing wave indicators". Polytechnic Research & Development Co., Inc., 202 Tillary St., Brooklyn 1, N.Y.

People—continued

Vogan

Taylor

Two vice-presidencies created

Expansion plans at Standard Wire and Cable Ltd. have prompted creation of two new vice-presidencies. **George W. Vogan** has been appointed vice-president in charge of sales, and **George V. Taylor** has been appointed vice-president in charge of manufacturing operations. Both Mr. Taylor and Mr. Vogan have been with the company since it was founded.

Arrow Radio co-founder has died

William W. Clelland, owner and co-founder of Arrow Radio Co., Toronto, died at his home in Port Credit, Ontario on July 4. Mr. Clelland was born in Scotland but spent most of his life in Canada. He has been active in the electronics industry for many years.

CDC strengthens contracts department

Two appointments have been made in the contracts department of Computing Devices of Canada Ltd. **Robert G. Salusbury** has been appointed contracts manager, succeeding K. G. Thorne who recently was appointed chief engineer of CDC. The assistant contracts manager is **John J. Shepherd.**

For the past year Mr. Salusbury has been manager of the CDC Decca department. Born in England, he studied engineering at Manchester University, and business administration at Cambridge. During the war he served as an RAF pilot, and retired with the rank of Wing Commander.

Salusbury

Shepherd

Mr. Shepherd has an honor BA from the University of London, and an MA in political science from McMaster. Born in England, he spent five years as an exectuive officer with the U. K. Air Ministry before coming to Canada in 1954. After serving a year with the electronics branch of DDP, he went to Canadian Westinghouse as contracts administrator on naval and missile programs. He joined CDC in 1958.

Linread appoints two directors

Linread Canada Ltd., Guelph, Ont., has appointed **Cyril C. Smith** and **G. A. "Jerry" Furlong** to the board of directors. Mr. Smith came to Canada in 1956 from the parent company in England. He became secretary of the newly formed Canadian company in 1958 and holds the position of secretary and general manager of the plant in Guelph.

Mr. Furlong, a native of Toronto and ex-hockey player, has been with the company three and a half years. He is in charge of sales.

Vice-president of Philips tv

The board of directors of Philips Industries Ltd. has named **Lloyd B. Kiely** vice-president in charge of sales of Philips television, radio and hi-fi products.

Kiely

Reports—continued

Canadian Marconi Co. as vice-president and general manager.

One major contract to date has been for 900 two-way radios for Lasalle Taxi Co. of Montreal. International Systcoms expects to launch production shortly of marine and aeronautical electronic communications equipment. They also hold the Canadian franchise for automatic telephone switchboards and PBX equipment manufactured by Hasler of Berne, Switzerland.

New principals and representatives

Electro Sonic Supply Co. Ltd., Toronto, and **Canadian Electrical Supply Co. Ltd.,** Montreal, have been appointed as Ontario and Quebec distributors for Philco transistors in quantities from 1 to 99 units. Industrial requirements for quantities of 100 and up are available directly from Philco at Don Mills, Ont.

Muirhead Instruments Ltd., Stratford, Ont., are now sole Canadian distributors for SYNCLAMPS, product of Timber-Top, Inc., Freeport, N.Y.

The Birtcher Corp., Los Angeles, Calif., has appointed **Lake Engineering Co. Ltd.,** Scarborough, Ont., as sole Canadian representative in the field of tube and transistor retention and cooling devices.

E. S. Gould Sales Co., Montreal has been appointed factory representative for all of Canada by the Communications Equipment Division of The Hallicrafters Company.

Company moves

Croven Ltd., manufacturers of quartz crystals and crystal ovens have moved to their new offices and plant at Beech St., Whitby, Ont. Postal address remains as Box 1420.

New manufacturers' representatives firm

A new company, Allan Crawford Associates, has been established to represent manufacturers of electronic instrumentation, covering the general test equipment, microwave and nuclear fields.

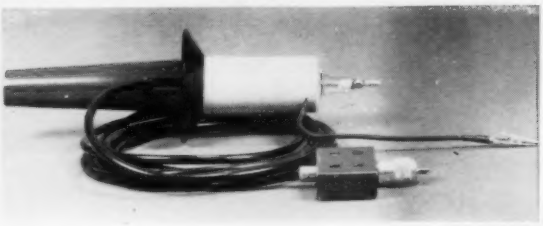
BALDOCK

Crawford

Owner is Allan Crawford, formerly with The Glendon Co. Ltd.; office is at Willowdale, Ont. (P.O. Box 214); telephone BAldwin 5-7391. Principals include Electronic Associates, Inc., Long Branch, N.J. (x-y plotters and digital voltmeters); Electronics International Co. and Riggs Nucleonics Co., Burbank, Calif.; John Fluke Mfg. Co., Inc., Seattle, Wash.; Technical Measurement Corp., North Haven, Conn.; and Weinschel Engineering Co., Kensington, Md.

New products

For more information on New Product items, use the Reader Service Cards on pages 57 and 58.



101

102

High-voltage probe 101

The Tektronix Type P1000 high-voltage probe for oscilloscopes is rated at 12 kv dc or rms, 25 kv peak. Attenuation ratio is 1000 to 1, risetime is 12 millimicroseconds, frequency response is dc to 30 mc. Input impedance is 2.5 uuf paralleled by 100 megohms. A compensating network at the oscilloscope end of the probe cable permits adjustment to oscilloscope input capacitances from 20 uuf to 47 uuf. The probe is 12" long, including handle, and has a 12-foot cable.

Textronix, Inc., Willowdale, Ont.

Meter housings of clear plastic 102

Clear housings molded of tough Tenite butyrate plastic help protect delicate meters for portable scientific equipment from the rough handling such apparatus must frequently encounter. At the same time, the transparency of the butyrate permits meter faces to be seen clearly. The housings have high impact strength but add very little to the weight of the meters.

Eastman Chemical Products, Inc., New York.

Differential transducer 103

Transducer model 70-3000 is operated by the displacement of a moveable core. This electro mechanical pressure differential transducer is suited for use in accelerometers and other measuring, indicating, gauging and process control devices. Linearity is 0-1%.

Renfrew Electric Co. Ltd., Toronto.

Compact display tube 104

A nine-pin display tube type 7AUP4 has been designed for airborne and monitor applications. The 7-in.-diam tube features a small ⅞-in. diam neck for decreased deflection power. The over-all length of the tube is 8⅜ in. and is of the electrostatic focus, magnetic - deflection type. Deflection angle is 70 deg. The tube has a P-4 phosphor and a metal-backed screen. Normal operating anode voltage is 8,000; grid number 2 voltage is 300; focus voltage from 0 to plus 300; cutoff voltage is minus 25 to minus 75.

Canadian Westinghouse Company Ltd., Hamilton.

Sub-miniature slip ring 105

Smaller in diameter than a cigarette, this assembly has its 50 slip rings and their attendant 100 brushes ball bearing mounted and packaged in a dust sealed housing only 1.250 inches in length. Noise levels are consistently maintained below 50 micro-volts. Breakaway friction level is kept under 50 gram centimeters. Brushes are tuned to different resonant frequencies to ensure constant electrical continuity despite severe vibration conditions. Unit withstands temperatures to 350 F and meets all requirements of MIL SPEC 5400A.

E. S. Gould Sales Co., Montreal.

Thermoelectric junction 106

Thermo-cell type TA-11 thermoelectric junction is designed for applications where it is desired to maintain a temperature which is either above or below the ambient. Control applications such as quartz crystal ovens, critical electrical circuits, etc., where relatively low heat input or extraction is involved, are typical applications. The cell can be used for cooling, heating, power generation and dynamic heat transfer. In normal room ambients, with an input power of 2 watts to the Thermo-cell, it is possible to obtain a temperature difference in excess of 40 C. With no external heat load, the cold junction temperature is —15 C. For generation purposes, an output power of approximately ¼ watt can be obtained from each Thermo-Cell with a temperature difference of 150 C.

Ohio Semiconductors, Inc., Columbus, Ohio.

Universal crystal filter 107

A new universal crystal filter for communications receivers on emergency frequencies has been developed by Monitoradio Div. I.D.E.A., Inc. Model CF-1 increases selectivity to permit reception of adjacent channels without interference. Fits standard 10.7 mc i-f transformer chassis cutouts. Centre frequency is 10.7 mc; band width is 15 kc; attenuation at ±30 kc is 40 db; insertion loss is less than 2 db.

A. T. R. Armstrong Ltd., Toronto.

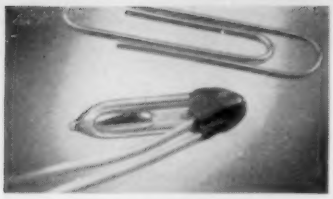
Scanning printer 108

Model 1961 electronic scanning printer works directly from logical levels and has a keyboard for supplemental data entry. It has 12 digit decoding and printing capacity for electrically controlled data from both decimal and binary-coded decimal sources. Data can be decoded during the print cycle. Input sources include step switch and electronic digital voltmeters, decimal and binary-coded decimal shaft position transducers, relay banks, selector switches, etc. Input resistance of the data input circuits is greater than 1 megohm.

Clary Corp., San Gabriel, Calif.

Microwave signal source 109

Polarad microwave signal source model KSS utilizes interchangeable plug - in microwave tuning units to cover the frequency range 1,050 to 11,000 mc. Output levels are 80 to 400 mw in the lowest



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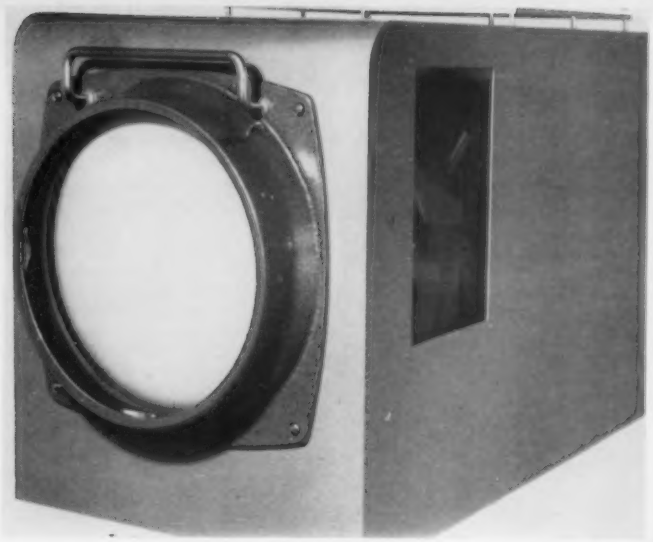


112

range and 14 to 40 in the highest. The instrument generates internal square wave signals variable from 10 to 10,000 pps, internal cw signals; and may be externally modulated. Pulse rise and decay time on external modulation is 0.15 usec minimum.

MEL Sales Ltd., Toronto.

Miniature mercury switch 110

Capsule-size mercury switch model AS419A1 weighs only 1.8 grams with leads attached and may be mounted in any position through 360 deg. around its longitudinal axis. It may be actuated by slow, snap or fast-tilting action. Contact arrangement is single-pole single-throw. The switch is electrically rated for a resistive load of 1 amp., 30 volts ac or dc; 0.5 amp., 110 vac or 0.75 amp., 110 vdc. On inductive loads it is rated at 0.75 amp., 30 volts ac or dc with inrush at 2½ times full load.

Honeywell Controls Ltd., Toronto.

Line voltage adjuster 111

This line voltage adjuster has been designed for use with equipment sensitive to abnormal line voltages. It has a double outlet receptacle and can accommodate line voltages of 85 to 125 volts, 60 cps to provide a steady output of 110 or 115 volts. It has a built-in 0-150 voltmeter and control is by means of a 10 point heavy duty cap switch with silver contacts.

Hammond Mfg. Co., Guelph, Ont.

Demonstration oscilloscope 112

This 12" demonstration oscilloscope has been specifically designed for use in lectures and demonstrations for the display and teaching of wave form analysis. Two separate wave forms can be presented simultaneously and all the controls are located at the rear of the instrument. Windows on either side of the unit allow the lecturer or operator to view the display without obscuring the screen.

E.M.I.-Cossor Electronics Ltd., Halifax.

Panel-mounted voltmeter 113

High input impedance and a broad frequency range are two features of the new model 311 ac panel-mounted electronic voltmeter designed by Metronix, Inc.

Input impedance is 5 megohms, paralleled by 25 uuf. Frequency range is 20 cps to 250 kc and accuracy is ±2% of full-scale deflection over the entire frequency range. A change of ±10% in line voltage causes a readout error of no more than 1% of full-scale deflection. Full-scale sensitivity begins at 10 millivolts and goes up to 300 volts rms.

Electromechanical Products, Agincourt, Ont.

Foil wound coils 114

Foil-wound coils offer greater flexibility than conventional wire-wound coils. They are particularly suitable for use with traveling wave tubes, klystron electro magnets, maser devices, and beamed-deflection magnets. The wafer coil's thinner insulation layer, combined with copper or aluminum foil, makes possible greater heat and space utilization efficiencies. Tube appendages and RF-connectors can pass directly through the windings of the wafer coil.

Hackbusch Electronics Ltd., Toronto.

Thermal analogue tube 115

Physically and thermally, the Thermion is identical to any vacuum tube of the same size class. In essence, it is a complete thermal analogue of the electron tube under study and can be used during initial design stages to test thermal conditions of component layout, heat dissipating hardware, etc. A vacuum tube's thermal state is a principal factor affecting its useful life.

Research Council, Inc., Waltham, Mass.

Radial double stub tuner 116

Model S-200 radio double stub tuner has been developed for the 100-2,000 mc range. With a weight of only two pounds and length of only 3⅜ in., the unit duplicates the performance of the "trombone" sliding stubs. The rotating tuning rings of the unit give calibration references from 0 to 25. The double stubs provide adjustment of 12.6 in. with 1.9 in. spacing. Characteristic impedance is 50 ohms.

Don-Lan Electronics Inc., Santa Monica, Cal.

Variable and fixed resistor networks 117

These self-supporting snap-in, two or three section variable and fixed resistor networks have been designed for printed circuit applications. Resistive elements are bonded to steatite ceramic. The variable resistor parts have a resistance range of 500 ohms through 5 megohms (linear taper), wattage rating of ¼ watt with 250 vdc max. across end terminals, full load rating at 70 C derated to no load at 90 C, voltage rating terminals to mounting bracket of 1250 vac for one minute high pot test with 500 vdc operating maximum. The fixed resistor parts are available with ratings up to 0.2 watts or 150 vdc max. Type X-153 is a 3-section unit measuring only 1-29/32 in. over-all length; type X-152 is a 2-section unit only 1-25/64 in. over-all length.

C. C. Meredith & Co. Ltd., Streetsville, Ont.

New products—con't.

Electronic colony counter 118

Bacterial colonies can be counted and marked simultaneously in a single probing action with this instrument. It records pathogenic and non-pathogenic colonies and provides the operator with four different counting devices: an electronic marking probe, electric marking pen, fixed pushbutton counter, and a remote pushbutton counter.

On contact with any agar medium the marking probe actuates a counting mechanism as it makes an identifying puncture in the colony. The self-activating marking pen is used where puncturing is not feasible. Slight pressure on the point triggers the counting mechanism and leaves a small ink spot on the glass or plastic plate. For sparsely populated plates, two pushbutton counting devices are available. All four counting devices, actuate a single, four-digit, electromagnetic counting mechanism.

New Brunswick Scientific Co. Inc., New Brunswick, N.J.

Temperature controller 119

Two companies have combined their experience to produce the type M226 temperature controller. It has an accuracy greater than 0.025% at 1,000 deg. C. A platinum resistance thermometer is formed into an ac powered Wheatstone bridge, the pre-set arm of which consists of a 1,000 ohm potentiometer graded in 4,000 steps, each being 0.25 deg. C. The out of balance voltage from the bridge is amplified and fed to a phase sensitive bridge which gives a positive or negative output according to whether the temperature is lower or higher than the correct setting. This output is amplified and applied to a control circuit. The controller was developed jointly by Winston Electronics Ltd., and United Steels Ltd.

Mechron Engrg. Prods. Ltd., Ottawa.

Miniature rotary solenoid 120

Leetronics hermetically sealed miniature rotary solenoid type LE 5 has the following tentative engineering specifications. It will operate on any voltage to 120 volts without external resistor (dc and/or ac to 2,500 cps without rectification.) Basic movement weighs only 3.7 grams; power or torque is 0.1 gram centimeter with 100 milliwatts input; ambient plus coil temperature not to exceed 300 F.

Wm. M. Hummel, Port Credit, Ont.

Wheatstone & kelvin bridges 121

Omega I wheatestone bridge measures from 0.05 to 50,000 omhs using an internal dc source. Omega II has the same ohmic range but will measure both ac and dc resistance as it contains an internal ac source. Omega III is a kelvin bridge which measures from 0.001 to 20 omhs. The accuracy of all three instruments is 1%. They are housed in black hard bakelite cabinets with internal galvanometers.

Conway Electronic Enterprises Reg'd., Toronto.

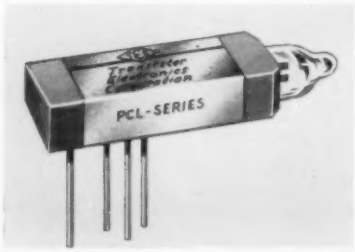
Power supply 122

The John Fluke model 301E power supply features direct read-out control, chopper stabilization and built-in standard cell reference. Output voltage is 1.02 to 512 vdc at 0 to 300 ma. Polarity is selective. Regulation against line or load is better than 0.005%. With a resolution better than 1/2 mv at any output voltage, the unit has a calibration accuracy better than 0.1%.

Allan Crawford Associates, Willowdale, Ont.

Printed circuit lights 123

Transistor Electronics Corp. has introduced a series of low signal indicating units designed for direct mounting on printed circuit boards. The encapsulated unit includes a neon indicator, transistor driver, circuitry and wire leads. It mounts on ½" centres, is ¼" high and may be used to drive remote indicators.



Lake Engineering Co. Ltd., Scarborough, Ont.

Delrin extrusions and fabricated parts 124

Du Pont's new thermoplastic Delrin is available in extrusions and abricated parts. The extrusions are in the form of strip, rod, tubing or special shapes. Strip comes in widths up to 7 inches and thicknesses from 0.020 to 0.093 inch. Rod diameters range from 1/2 inch to 2 inches. Tubing and special shapes are made to order.

National Fibre Co. of Canada Ltd., Toronto.

(Continued on page 51)

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Model 2610

1958
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The wide and immediate acceptance of the Model 2610 has provided ample justification for the original techniques adopted in the design of this instrument. Versatility and convenience, allied with precision performance, make this an ideal oscilloscope for general laboratory use.

The vertical deflection system has a sensitivity in excess of 3.3 millivolts r.m.s./cm. and offers a choice of A.C. or D.C. coupling with either a linear response to 6 Mc/s or a suitable roll-off for transient observations; in the latter condition the rise-time is 80 millimicroseconds with overshoot less than 3%. For pulse observation a 0.3 microsecond signal delay can be switched in. Marker signals can be applied via a differential input terminal.

Associated with the vertical deflection system is a unique and permanent internal calibration circuit which, in conjunction with the built-in meter, permits the measurement of waveform amplitudes to an accuracy of 3%.

The horizontal deflection system offers recurrent sweeps from 3 c/s to 500 Kc/s and precalibrated triggered sweeps of 5, 50, 500 and 5,000 microseconds duration; triggering and blanking can be either internal or external or an external time base signal can be applied.

A flat-faced 5" C.R.T. is used and provision is made for camera mounting.

Conservative operation of components, combined with ingenious design, makes it possible to provide this high standard of performance with reliability, and at a remarkably modest cost.

Price, including signal cables, line cord, graticule and filter — $550.00, f.o.b. London, Sales Tax Extra.

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New products—con't.

Multi-purpose ultrasonic cleaning unit 125

Multi-purpose SonBlaster series 400 ultrasonically agitates the contents of two 400 ml pyrex glass beakers. It can wash and rinse parts simultaneously, use two different solutions at the same time, use any chemical, acid or alkali solvent in glass beakers, or use the stainless steel tank without beakers. It operates by plugging into a standard 115 volt, 50/60 cps outlet.

MEL Sales Ltd., Toronto.

Sampling oscilloscope 126

Hewlett-Packard model 185A oscilloscope uses a sampling technique to provide a clear display of pulses requiring resolution up to 500 mc. Calibrated sweeps are compatible with the bandwidth of the oscilloscope and vary from 0.001 uusec/cm to 0.1 uusec/cm. Rise time is approximately 0.0007 uusec. The sweep delay control and magnifier provide a convenient means for synchronizing through an external trigger.

Each sample point is delayed from the preceding sample an incrementally increasing amount so a different part of the signal is studied each time. After a predetermined number of samples (50 to 1,000) the entire signal has been explored and the actual wave form recreated on the crt.

Atlas Instrument Corp. Ltd., Toronto.

Relay latches magnetically 127

Sigma series 32 subminiature polarized relay uses magnetic latching to eliminate the need for stand-by power. It is hermetically sealed, measures 0.8 x 0.4 x 0.9 inches and weighs only 18 grams. Available with either single or dual coils, it has standard operating sensitivities of 50 milliwatts for the single coil and 100 milliwatts for each coil of the dual-coil version. Operating temperature range is from —65 C to +125 C. The relay armature is transferred from one fixed position to the other by a coil signal of the correct polarity and magnitude, and is held in place by a permanent magnet.

Arva, Vancouver (West) and D. T. Shaw, Montreal (East).

(Continued on page 52)

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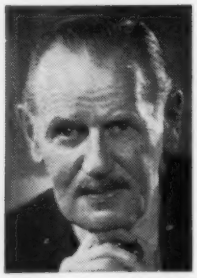

says Floyd S. Chalmers,

President of Maclean-Hunter Publishing Co. Ltd., at the 1959 Shareholders' Annual Meeting.

'Our business is that of communication. Our publications exist to carry ideas. In 1958, they published 49,000 pages of editorial and advertising material. They have a total circulation of two million and their distribution runs to 36 million copies a year. Each and every one of these copies is an instrument of service and information for one or more persons.

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New products—con't.

New Megger instruments 128

Several new instruments have been developed by Evershed & Vignoles Ltd., 6-voltage Megger insulation tester provides six switch-selected test voltages which make the instrument suitable for step-voltage resistance tests, time resistance tests and dielectric absorption tests. It operates on the AC supply with an output voltage from 500 to 2,500.

Megger Dielectric Testing Set is an ac driven timing device that can be incorporated in ac operated series 1 insulation testers. Universal Ground Tester has been designed for geophysical surveying, siting for and measure of grounding electrods, and ground resistance measurements for cathodic protection. The scale is semilogarithmic to provide greatest accuracy in the area where it is most desired.

Two models of the "59" ducter low resistance testing set have been developed. One is ac operated and completely self-contained including power supply and hand spikes. The other is battery operated, also self-contained. Both instruments cover ranges of 0.10,000 microhms in 3 decades, and 0-1 ohm in 3 decades.

R. H. Nichols Ltd., Toronto.

Epoxy resin kits 129

Emerson & Cuming, epoxy resins are available in pre-weighed amounts and packaged in polyethylene film bags or in dual aluminum tubes. An exact amount is packaged for a one-time use. Resin and curing agent are separated in the polyethylene bag; the user removes the separator, kneads the contents, opens the bag, and applies the compound to the job. Dual aluminum tube packaging is an arrangement wherein equal lengths of resin and curing agent are squeezed out

side by side, mixed with the supplied spatula and used. Emerson & Cuming will package kits for any requirement and to any customer specification.

M. J. Howard Co. Ltd., Ottawa.

Ferrite isolator 130

This low power Ku-band ferrite isolator has been designed to improve the performance of a klystron excited system. Model 1KuI.4 provides a minimum isola-

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The General Electric dramatic BIG LOOK in small panel instruments gives you excellent readability plus reliable operation in a truly distinctive design. These new, competitively priced instruments provide up to 28% increase in scale length, yet fit into the same space as ordinary instruments.

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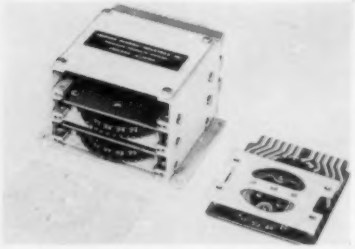
tion of 25.0 db with an insertion loss of no more than 0.45 db across the band from 16.0 kmc to 17.0 kmc with a vswr of 1.12 maximum. It is rated at 5 watts average power, weighs 2.9 ounces and is 0.66 inches in length.

Raytheon Canada Ltd., Waterloo, Ont.

Modular rotary switch 131

The units of this printed circuit, manually operated rotary switch can be removed and replaced in seconds without unsoldering, disassembling or wire removing. A modular bank of 25 switches can contain up to 500 separate switching circuits. Each switch needs only ½" panel space and the switching circuits are actuated manually by a rotary wheel giving visual digital indication of switch position.



Chicago Dynamic Industries, Inc., Chicago.

Wire stripper 132

General Cement Manufacturing Co. Strip-Er-Clip will strip and clip all wire sizes from 14 to 26 gauge. A selector wheel, easily moved with the thumb, selects any of seven different wire sizes.

Charles W. Pointon Ltd., Toronto.

Servomotor-rate generator 133

This Helipot size 11 servomotor-rate generator model 11 MG 630/600, has been designed for systems using 60 cps power. It weighs only 7.5 ounces, yet will operate continuously at stall at a unit temperature of 200 C.

Designed to be driven by a 6.3 volt filament supply, the generator takes a power input of 3.8 watts with a power factor of 0.99. Excitation input up to 26 volts is available. The motor control phase is wound for 40 volt centre tap fixed phase, for 57½ volts. Winding can be altered to go as high as 115 volts.

R-O-R Associates Ltd., Don Mills, Ont.

Permanent magnets 134

Indox VI permanent magnets have been designed for traveling wave tube applications. They are made of barium-iron oxide oriented material. Typical properties include a coercive force (Hc) of 2550 oersteds, a residual induction (Br) of 3,200 gauss, and a peak energy product of 2.4 x 106.

The Indiana Steel Products Co. of Canada Ltd., Kitchener, Ont.

(Continued on page 55)

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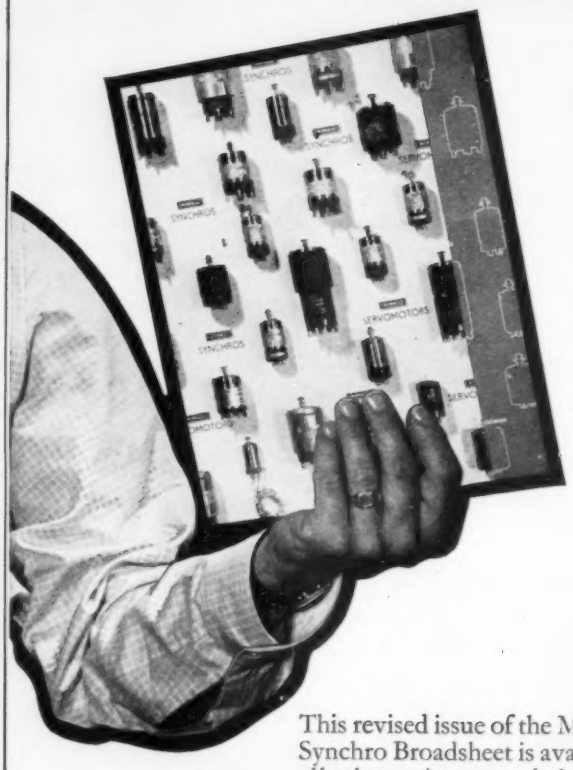

This revised issue of the Muirhead Synchro Broadsheet is available to all those interested in servo engineering. Prepared in tabular form for easy reference, it presents the brief specifications of Muirhead Control Transmitters and Receivers; Motor Tachometers and Tachometer Generators; Two-Phase Servomotors and Resolvers and Linvars in Standard Synchro frame sizes.
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Defence contracts

Unclassified electronics contracts for $10,000 or more have been awarded to the following Canadian firms by the Department of Defence Production. A figure in parenthesis indicates the number of contracts, the amount being the total value.

June 16-30, 1959

Aviation Electric Pacific Ltd., Vancouver, repair and overhaul of aircraft instruments, $105,820.

Campbell Mfg. Co. Ltd., Willowdale, Ont., radio spares, $53,464.

Canadian Arsenals Ltd., Ottawa, testing of electronic equipment, $290,000.

Canadian National Railway Co., Ottawa, rental of telephone and teletype facilities, $88,000.

Canadian Pacific Railway Co., Ottawa, rental of telephone and teletype facilities, $89,000.

Computing Devices of Canada Ltd., Ottawa, technical services, $21,632.

Hydro-Electric Power Commission of Ontario, Toronto, testing of electronic equipment, $345,000.

Instruments (1951) Ltd., Ottawa, repair and overhaul of aircraft instruments, $110,000 (2).

International Business Machines Co. Ltd., Ottawa, rental of office machines, $180,697 (3).

Northern Electric Co. Ltd., Ottawa, telephone cable and wire, $10,483.

R.C.A. Victor Co. Ltd., Montreal, technical services, $15,592, radar equipment, $702,777, microwave equipment, $57,029.

Remington Rand Ltd., Ottawa, rental of office machines, $144,929.

Sperry Gyroscope Co. of Canada Ltd., spares for aeronautical equipment, $12,775.

July 1-15, 1959

Amphenol Canada Ltd., Toronto, rf cable, $17,915.

Aviation Electric Ltd., Montreal, technical services, $13,100.

Bayly Engineering Ltd., Ottawa, equipment, $29,600.

Canadian Applied Research Ltd., Toronto, publications, $16,332.

Canadian Comstock Co. Ltd., Edmonton, provision and installation of telecommunication cable, $38,684.

Canadian General Electric Co. Ltd., Toronto, technical services, $18,179.

Computing Devices of Canada Ltd., Ottawa, technical services, $85,000.

Honeywell Controls Ltd., Leaside, Ont., repair and overhaul of aircraft instruments, $408,000.

Maitland Development Co. Ltd., Maitland, Ont., sonar recording paper, $12,381.

Marsland Precision Equipment Ltd., Waterloo, Ont., electronic components, $23,279.

Protective Plastics Ltd., Scarborough, Ont., radomes and spares, $505,202 (3).

R-O-R Associates Ltd., Don Mills, Ont., tubes, $99,400.

New products — cont.

Time cycle controller 135

Time cycle controller model C1C500 provides flexibility for controlling processes based on timed operations. It can control as many as ten different variables. Dogs set on the periphery of the timing disc determine the timing of pilot operations. Intervals between operations can be as brief as four seconds, and timing discs range from 0-15 minutes to 0-360 minutes.

The Bristol Co. of Canada Ltd., Toronto.

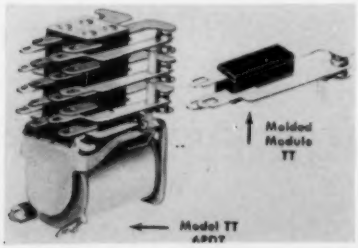
Electronic reticle 136

Electronic reticles etched on the face plate of a vidicon tube are in the exact focal plane and can be transmitted simultaneously with the televised scene, appearing superimposed in correct relationship to the subject shown on the monitor. Patterns can be etched on the inner face of the transparent face plate with reticle lines 1 mil wide and about 2 mils deep. They can be filled with either one of two inert substances to produce either white or black lines when viewed upon the monitor image. Electronic reticles may be applied to standard 1-inch vidicons and also orthicons and storage tubes. They are produced to customers' specifications with a delivery time of 4 to 6 weeks.

Grimson Color, Inc., New York.

Modular relays 137

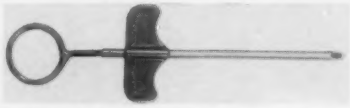
Ohmite Mfg. Company's model TT and TS relays are designed expressly to meet military requirements, particularly those set forth in MIL-R-5757C and MIL-R-6106C. A design innovation is the molding of standard contact spring combinations into integral units or modules. These assure unvarying alignment, and permanence of adjustment of mating contact springs as well as more accurate alignment of whole combinations on the relay. They can be furnished to operate in ambients as high as 125 deg. C, and are available in military type hermetic enclosures.



A. C. Simmonds & Sons, Ltd., Toronto (East), and C. M. Robinson Co., Winnipeg (West).

Shielded wire lead extractor 138

This tool removes insulated lead wire from braided shields. Similar to a hypodermic needle, the extractor ejects the lead wire from a breakout in the shield produced by the tube point. The five sizes will process most shielded wires from 30 AWG to 14 AWG. Produced by Technical Devices Co., each extractor is color-coded for size identification.



Ray Johnston Co., Seattle.

Communications receiver 139

Northern Radio Co. model N625F is a six-channel portable crystal-controlled receiver covering the range 2 to 6 mc. Eight transistors are used including an rf stage and push-pull output stage which delivers ½ watt to the self-contained loudspeaker. There is a built-in telescoping antenna with connection for an external antenna. Normal power supply consists of six flashlight cells housed in the case but there is a connection for an external battery. Complete weight is only 5½ lbs.

Tele-Radio Systems Ltd., Toronto.

Production recording system 140

Centralograph is a system for recording the stopping and starting of a number of different machines simultaneously. It consists of a central unit linked by a network of wires to an electric impulse contact mounted on each machine. When the machine is in operation, impulses are sent to the central unit which records them on a continuous paper roll. The reasons for each stoppage are signalled in code by the machine operator on a dial similar to that of a telephone.

Ericsson Telephone Sales of Canada Ltd., Montreal.

Transistor transformer reference kit 141

This James Vibrapower Co. transistor transformer kit consists of a complete set of 12 precision matched miniature transformers, each covering a portion of the normal range of impedance ratios used in transistor circuitry. It allows the engineer to keep the transformers available for prototype work, with all the information necessary to generate a final production specification. All transformers are bifilar wound with a complete four winding eight terminal configuration. A test socket, design manual and Co-Netic foil are included.

Telequiment Manufacturing Co. Ltd., London, Ont. END

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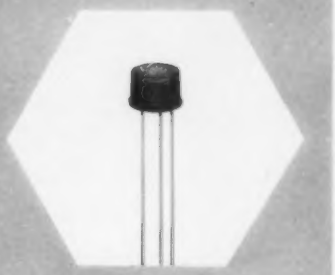

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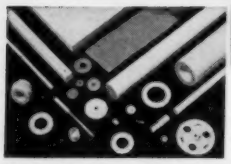

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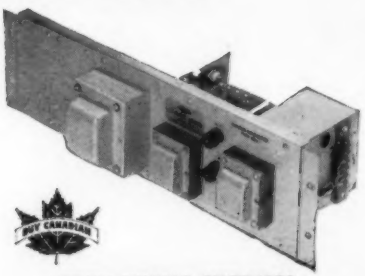

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OHMITE®

THE QUALITY LINE OF INDUSTRY-PREFERRED COMPONENTS

Adjustable Dividohm® Resistors

DIVIDOHM resistors are vitreous-enameled units with a narrow strip of the resistance wire windings exposed for contact with an adjustable lug. They are ideal for voltage dividers, obtaining odd resistance values, or matching line voltages. Tube-type units have a scale for lug settings and are available in seven stock sizes and in many resistance values. **Write for Stock Catalog 30.**

OHMITE Manufacturing Co.
3623 Howard St., Skokie, Illinois

RESISTORS RELAYS TAP SWITCHES
RHEOSTATS TANTALUM CAPACITORS
R. F. CHOKES VARIABLE TRANSFORMERS DIODES

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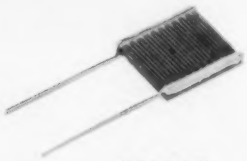
1.0 WATT



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- INEXPENSIVE
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- RATED 220 V.A.C.
- HERMETICALLY SEALED TYPES
- STABLE, HIGH POWER

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Industrial counters
Obstacle markers
Door openers
Burglar lights or indicators
Safety interlocks
Photographic processes

The output of these cells is such that no additional electronic amplification is necessary and power requiring devices such as relays and small motors may be directly controlled by the cell itself.

PAYETTE RADIO LIMITED

730 St. James West, MONTREAL, QUE., UN. 6-6681

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with
HIGH COMPONENT DENSITY

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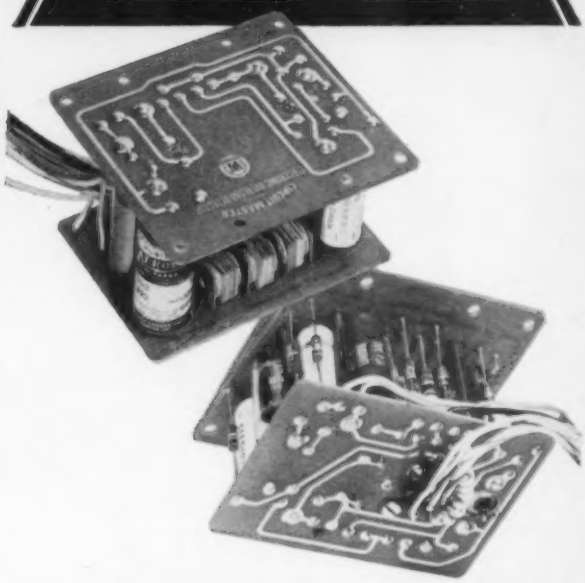

Printed Circuits Make It Possible

The parallel circuit construction of this electronic press control demonstrates the compactness which can be achieved with printed wiring boards. This electronic package is responsible for the automatic protection of expensive equipment and must perform reliably over a lengthy span of time under fluctuating operating conditions.

Printed Wiring Boards are available single or double sided, with solder or precious metal finish and eyeletted or with plated-through holes.

Completely assembled units can be dip or hand soldered. Moisture-proofing to military specification is optional. All units are thoroughly tested.

United-Carr has the facilities to design and build printed circuits or complete electronic assemblies to your specification, in production quantities.

For detailed information contact our Technical Representative

UNITED-CARR FASTENER COMPANY OF CANADA LIMITED
231 Gage Avenue North, Hamilton, Ontario
Sales Offices: Hamilton, Toronto, Montreal

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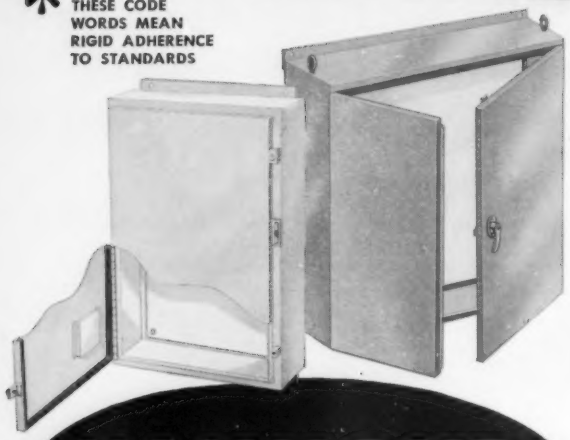
J·I·C * N·E·M·A·12

* THESE CODE WORDS MEAN RIGID ADHERENCE TO STANDARDS



HAMMOND
PANEL ENCLOSURES

Moisture-proof · Dust-proof

Hammond J.I.C. and N.E.M.A.12 Enclosures have achieved wide popularity with Canadian Industry as a most satisfactory method of housing electrical control equipment in moist, steamy, oil or dust-laden atmospheres. Construction provides a removable mounting panel and permits good visibility with maximum accessibility. The cabinets have a durable baked enamel, grey exterior, white interior finish and offer a pleasing appearance for installations which must be kept on display.

A complete range of sizes from 12″ x 24″ x 6″ to 72″ x 72″ x 12″ is available. They are made from heavy gauge steel, all-welded, and designed to resist distortion. Doors are completely gasketed with cellular neoprene permanently held by channeling to protect against spray from cutting-oil, hose washdowns and other hazardous environment.

Mounting feet and Drip Shield are optional.

CAPTIVE-LID CABINET

These rigidly constructed panel enclosures are stocked in sizes from 4″ x 4″ x 3″ to 16″ x 14″ x 6″. Finished in baked gray enamel over phosphatized steel.

DISTRIBUTED FROM COAST TO COAST BY LEADING JOBBERS

HAMMOND MANUFACTURING CO. LTD.
GUELPH, ONTARIO, CANADA H/16

For further information mark No. 23 on Readers' Service Card

mark any wire — faster, at lower cost!

BRADY PERMA-CODE WIRE MARKERS

Self-sticking — go on fast to any type wire. Tell which wire goes where. Cost less than ⅛¢ per lead. All-vinyl, polyester film, glass cloth, aluminum foil, vinyl-cloth. Color coded to meet NEMA specifications.

Write for free working samples — and Bulletin 130.

W. H. BRADY CO. OF CANADA LTD.
Manufacturers of Quality Self-Sticking Industrial Products.

Dept. WM-3
1 Research Road • Brampton, Ont., Canada

For further information mark No. 15 on Readers' Service Card

"SPEEDIVAC"

HIGH VACUUM PUMPS
for industrial processing

New large capacity rotary high vacuum pumps are designed for simple, trouble-free operation with all types of vacuum systems. Outstanding features include . . . clean compact design . . . internal lubrication system with magnetic valve . . . gas ballast . . . hand tight vacuum union for easy system connection. Ultimate vacuum blank off 0.01 MM of mercury. Combinations of these single stage pumps with a smaller model gives an economical two stage performance to 0.001 MM of mercury.

Consult us on all High Vacuum applications.

Dozens of applications: chemical processing, distillation, impregnation, metallurgy, etc. Send for information

EDWARDS HIGH VACUUM (CANADA) LTD.
CUMBERLAND AVENUE, BURLINGTON, ONTARIO

For further information mark No. 19 on Readers' Service Card

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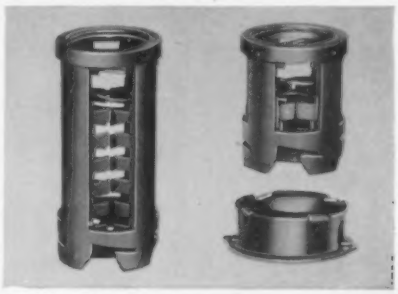
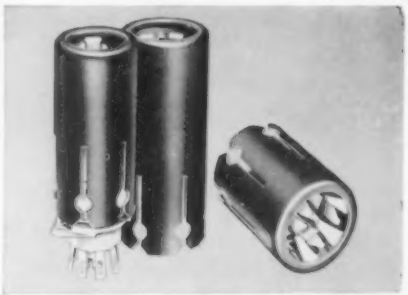
I. E. R. C. HEAT DISSIPATING TUBE AND TRANSISTOR SHIELDS

ensure maximum cooling, retention, shock protection and greatly extended tube life!

The military type "B" Series used on tubes operating at normal room ambient will reduce bulb temperature as much as 60% below bare bulb temperature. Meets requirements of Mil - S - 9372B (USAF) and Mil - STD - 242A (Ships). Recommended by the Military for all new equipment design.



NOW STOCKED IN CANADA



The TR Series miniature tube shield is designed for direct replacement of JAN - S - 28A shields and to fit standard JAN - S - 28A sockets and base assembly. The TR shields meet MIL - S - 9372B.

Call or write for

- **Test reports**
- **Tube shield guide**
- **Catalogue**
- **Prices**

R O R

Heat reducing shields for all power transistors and ortal, miniature, subminiature and power tubes available for immediate delivery.

R-O-R ASSOCIATES LIMITED

1470 DON MILLS RD., DON MILLS, ONT.

TORONTO Hickory 4-4429 **TELEPHONE** **MONTREAL** HUnter 1-0700

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New method may improve wire line transmission of radio programs

Canadian National Telegraphs engineers are testing a new technique for wire line transmission of broadcast material. If successful, it will allow transmission of standard 5 kc CBC Trans-Canada Network programs from Edmonton to Whitehorse. This material is now being carried on a 3 kc carrier voice channel.

When built by the United States Army Signal Corps during World War II to link the continental U. S. with Alaska, the system was equipped with C carrier equipment. This operates in the 5 to 35 kc range.

The system was built, as a wartime precaution, with 100-mile repeater spacing which allowed for the destruction of non-adjacent repeaters without significantly impairing transmission.

Postwar expansion of the line was brought about by superimposing 6-channel high frequency carrier systems on the existing facilities above the C carriers.

These, unlike 12-channel hf carrier systems, operate in the range of 40 to 90 kc, as opposed to 40 to 140 kc.

At the present time CNT engineers are conducting tests to take existing carrier program channel equipment and adapt it for use on 6-channel systems so that standard 5 kc program service may be established to Whitehorse.

This will be done without disturbing existing low pass way circuits which provide telephone service to isolated roadside points, or involving capital expenditures.

CCBA engineers prepare for conference

The engineering section of the Central Canada Broadcasting Association will hold its 1959 conference Oct. 20 and 21 at the King Edward Hotel, Toronto. Due to a number of transfers and changes in responsibility for former members of the executive, a new slate has been appointed. Past chairman Bill Onn, CHLO, has been reappointed chairman; Manufacturers' liaison member is F. Lehman, CFRB, (Box 122, Clarkson, Ont.), and secretary-treasurer is J. Smith, CKCO-TV.

Technical films on atomic energy

The U. S. Atomic Energy Commission has announced that the 45 technical-level, professional motion pictures first screened last September in Geneva at the Second International Conference on the Peaceful Uses of Atomic Energy, are available for loan and sale. Enquiries should be directed to the Public Information Service, U. S. Atomic Energy Commission, Washington 25, D.C.

The list includes 10 films on power reactors, 9 on research and test reactors, 3 on reactor safety, 7 on fuels and processing, 1 on particle accelerators, 1 on controlled thermonuclear research, 1 on agricultural research, 11 on biomedical work, and 2 on industrial applications.

Systems planners will meet in Toronto

More than 1,200 members and guests of the Systems and Procedures Association are expected to attend the three-day 1959 International Systems Meeting at the Royal York Hotel, Toronto, October 12-14. The registrants will consist mainly of administrative executives serving business, commerce, education, government and military.

The general program will be divided into three study areas—systems panorama, seminars, and systems futurama. Exhibits of office machines and systems operations will emphasize data processing equipment.

Full details may be obtained from the general chairman of the meeting, George K. MacDonald, Bank of Nova Scotia, 44 King St. West, Toronto, Ont.

Frequency allocation for space communications

The International Telecommunications Union met in Geneva last month to discuss international regulation of communications. Their primary objective was to review and revise the international allocation of radio frequencies.

The United States delegation proposed that seven radio bands be set aside solely for space communications. These would be for the use of space vehicles and fixed stations on the moon or the planets.

The problem of interference could become quite serious as more and more satellites are launched, with power sources that could keep their transmitters in operation for several years.

COMING EVENTS

September

21-25 Annual conference and exhibition, Instrument Society of America, Chicago.

23-25 Technical Conference on Non-Linear Magnetics and Magnetic Amplifiers. Washington, D.C.

28-30 National Symposium on Telemetering. San Francisco, Calif.

October

5-7 Fifth National Communications Symposium, Utica, N.Y.

7-9 IRE Canadian Convention, Exhibition Park, Toronto.

12-14 1959 International Systems Meeting of the Systems and Procedures Association of America, Toronto.

12-14 The 15th National Electronics Conference, Chicago.

20-21 Central Canada Broadcasters Assoc., Engineering Conference, Toronto.

29-30 PGED 5 annual electron devices meeting, Washington, D.C.

November

9-11 EIA-IRE Radio Fall Meeting, Syracuse, N.Y.

10-12 Twelfth Annual Electrical Techniques in Medicine and Biology Conference. Philadelphia, Pa.

Special issue for IRE Convention

With October comes the IRE Canadian Convention and Exposition in Toronto. CEE is preparing an important pre-show issue which will give readers all the information they want about every aspect of the convention. This will include:

Complete details of the technical program with abstracts of all papers.

Full list of exhibitors, booth numbers, personnel, and details of products to be shown.

Special new products section.

Floor plan of the exhibition hall with reference list of exhibitors.

List of events, officials and other general information.

Photographs and biographical sketches of the authors delivering technical papers.

The October issue will also contain feature articles and regular departmental news.

LOOK! one new instrument useful 2 ways

① Microvoltmeter-Micromicroammeter measures to 1 μv, 1 μμa!

② Sensitive high-impedance voltmeter

input values to approximately 400 megohms!

New hp 425 Microvolt-Ammeter

This versatile new hp instrument serves you in many ways. It is a high sensitivity microvoltmeter measuring to 1 μv, and a micromicroammeter measuring to 1 μμa with sensitivity 10 times that previously available. Drift is less than ± 2 μv/hour and noise is less than 0.2 v RMS.

Or, with a simple factory modification offered at no extra cost, the input impedance can be increased to approximately 400 megohms. This insures accurate measurement without loading on most high impedance circuits. In many situations, the 425A thus performs measurements for which expensive electrometers were previously required.

Model 425A also serves as an ohmmeter, measuring resistances from milliohms to 10 megamegohms in conjunction with an external constant current.

Other unique features include a photoelectric chopper replacing the conventional multi-vibrator, heavy ac filtering, protection against momentary overloads up to 1,000 volts, and a new probe minimizing thermocouple or triboelectric effects.

HEWLETT-PACKARD COMPANY

Represented in Canada by **ATLAS INSTRUMENT CORPORATION, LTD.**
50 Wingold Ave., Toronto, Ontario; 106-525 Seymour St., Vancouver, B.C.;
72 Princess St., Winnipeg, Manitoba

SPECIFICATIONS

MICROVOLT-AMMETER

Voltage Range: Positive and negative voltages from 10 μv end scale to 1 v end scale in an eleven step, 1-3-10 sequence.

Current Range: Positive and negative currents from 10 μμa end scale to 3 ma end scale in an eighteen step, 1-3-10 sequence.

Input Impedance: Voltage Ranges: 1 megohm ± 3%. Current Ranges: 1 megohm to 0.33 ohm, depending on range. (With factory modification, over 200 megohms. Please specify Model H 01-425A in ordering; no extra cost).

Accuracy: Within ± 3% of end scale.

AMPLIFIER

Ac Rejection: At least 3 db at 0.2 cps, 50 db at 50 cps, approx. 60 db or more at 60 cps.

Gain: 100,000 maximum.

Output: 0 to 1 v for full scale reading, adjustable.

Output Impedance: 10 ohms, shunted by 5000 ohm potentiometer.

Noise: Less than 0.2 μv rms referred to input.

Drift: After 15 minute warm-up, less than ± 2 μv per hour referred to the input.

Power: 115/230 v ± 10%, 60 cps, 40 watts.

Dimensions: Cabinet Mount: 7½" wide, 11¼" high, 14" deep.

Weight: Net 17 lbs.

Price: hp 425AR (rack mount) $505.00. hp 425A (cabinet) $500.00.

Data subject to change without notice. Prices f.o.b. factory.

hp Quality and value standard in test instrumentation

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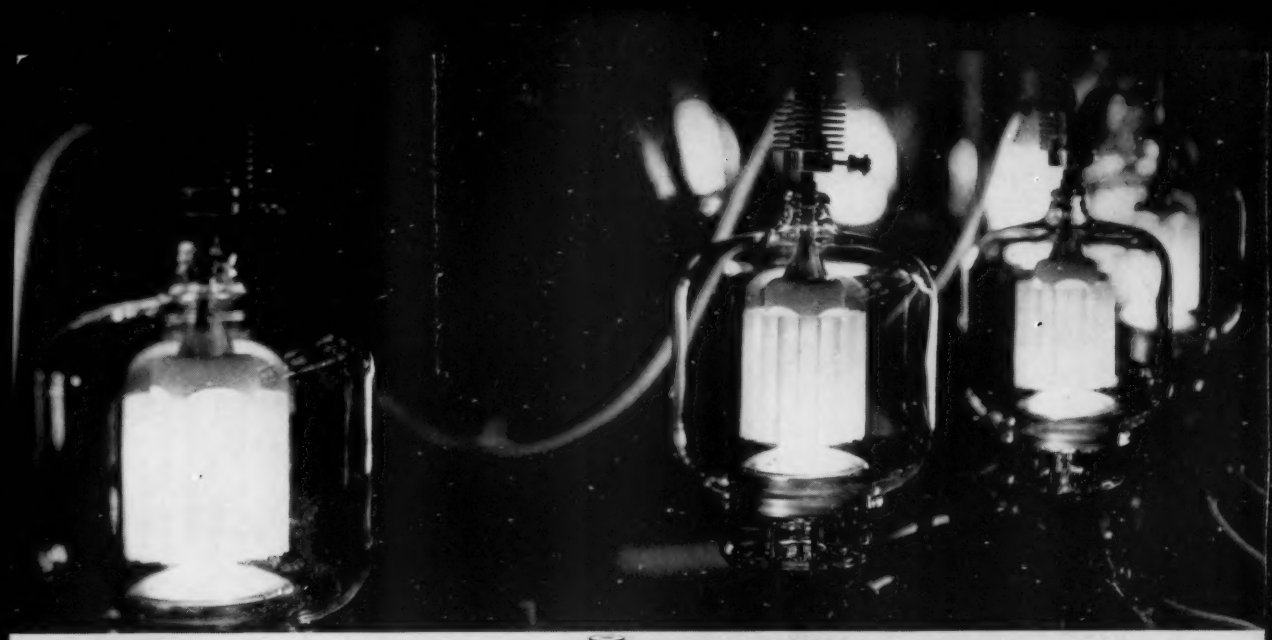

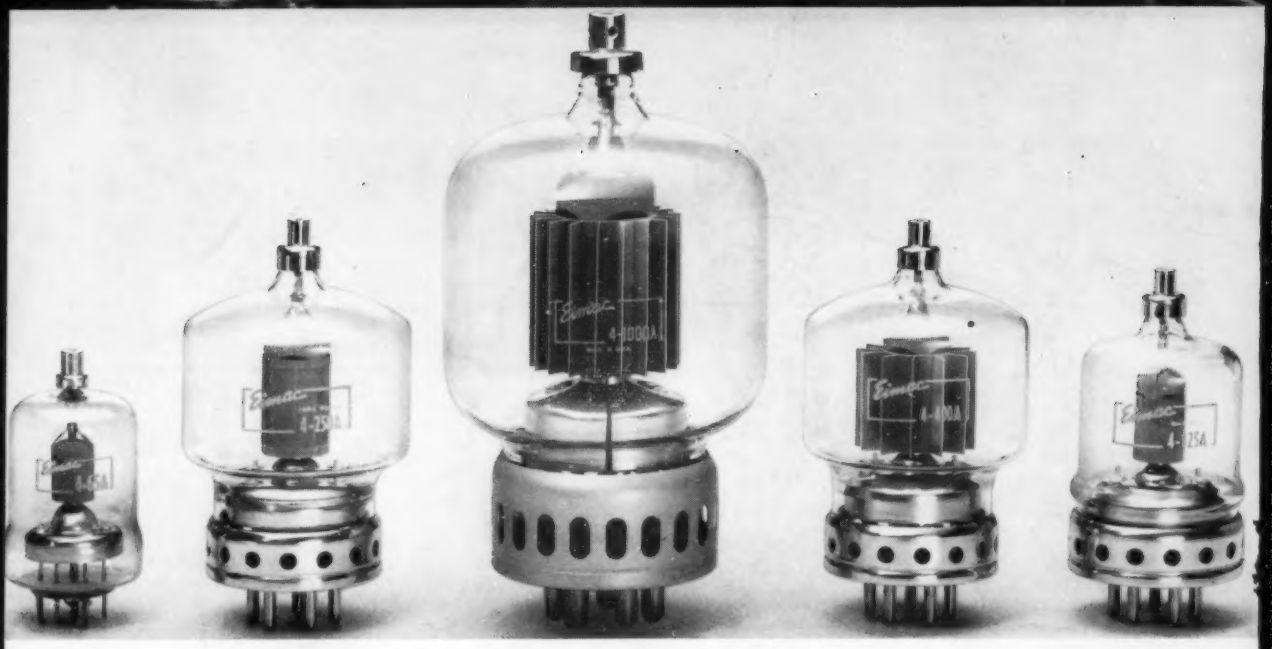

EIMAC PIONEERED INTERNAL-ANODE TETRODES— PERFORMANCE LEADERS FOR OVER A DECADE

Developed and introduced to the industry in the mid 1940's, Eimac's line of internal-anode radial-beam tetrodes immediately received widespread and enthusiastic acceptance. Well over a million have been sold since that time. These tubes, quality leaders from the very start, still maintain that position through advanced processing techniques, inherently sound design and continuing concern with production refinements.

Clean electrode design, for example, and the exceptionally hard vacuums achieved on Eimac-developed rotary vacuum pumps, result in consistently reliable tubes with an exceptional ability to withstand high momentary overloads and peak powers. Rugged filament design with high reserve emission contributes greatly to their reliability and long life.

Stable operation at high frequencies is assured by low inter-electrode capacitances and low lead inductances. Driver requirements and associated circuitry are simplified by the high power gain and low driving power requirements of these tube types.

These features, plus other Eimac design innovations such as the Pyrovac* plate and non-emitting grids make Eimac internal-anode tetrodes your logical choice for new equipment designs, as well as tube replacements, when exceptional performance and reliability are required. Most types available for immediate delivery.

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